ABSTRACTS OF NORTH AMERICAN GEOLOGY

June 1966

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1966

UNITED STATES DEPARTMENT OF THE INTERIOR

STEWART L. UDALL, *Secretary*

GEOLOGICAL SURVEY

William T. Pecora, *Director*

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402.
Price 45 cents (single copy). Subscription price: $5.00 a year (12 monthly issues); $1.25 additional for foreign mailing. Use of funds for printing this publication approved by the Director of the Bureau of the Budget (December 8, 1965).
(exp. 12-68)

ABSTRACTS OF NORTH AMERICAN GEOLOGY

INTRODUCTION

Abstracts of North American Geology contains abstracts of technical papers and books and also citations of maps on the geology of North America including Greenland, the West Indies, as well as the State of Hawaii, Guam, and other island possessions of the United States. Articles of a general nature by North American authors are cited even though published in foreign journals, but those by foreign authors are included only if they appear in North American journals. Abstracts are prepared only of material that is believed to be generally available. Ordinarily abstracts are not published of material with limited circulations (such as dissertations, open-file reports, or memorandums) or of other papers presented orally at meetings.

The Abstracts will be an additional reference tool but will not replace the Bibliography of North American Geology, which has been published by the Geological Survey since 1887. Twelve monthly issues of Abstracts of North American Geology will be published each year. The Bibliography will include citations and subject index for a calendar year.

Abstracts of North American Geology and the Bibliography are being prepared by use of computer techniques. Each abstract along with its indexing is placed on magnetic tape and entered into a permanent data bank. The material prepared each month will be published in the form of the present issue. The abstracts are arranged alphabetically according to senior author. A subject index follows the abstracts and is designed for rapid reference to any subject desired. Bibliographies can subsequently be retrieved according to the terms used in the index.

The abstracts in this issue were prepared by J. P. Albers, G. O. Bachman, A. P. Butler, Jr., R. A. Cadigan, Georgianna D. Conant, Margaret Cooper, S. C. Creasey, Eleanor J. Crosby, W. C. Culbertson, Wanda L. Grimes, Andrew Griscom, J. J. Hemley, Virginia M. Jussen, B. H. Kent, Elisabeth S. Loud, S. H. Mamay, E. K. Maughan, E. D. McKee, Mildred C. Mead, Virginia S. Neuschel, D. W. Rankin, R. J. Roberts, S. P. Schweinfurth, G. R. Scott, H. A. Tourtelot, Dorothy B. Vitaliano, and R. G. Yates.

ABSTRACTS

Abbott, D. *See* Deer, W. A. 3323

3277 **Ablewhite, K.; Higgins, G. E.** A review of Trinidad, West Indies, oil development and accumulations at Soldado, Brighton Marine, Grande Ravine, Barrackpore–Penal and Guayaguayare [abs.]: Bol. Inf., v. 8, no. 3, p. 73–74, 1965.

2787 **Ager, D. V.** Serial grinding techniques, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 212–224, illus., 1965.

The techniques described were developed particularly for the study of the internal structures of brachiopods, but are equally applicable to many other groups. Grinding techniques are divided into selection of specimens, burning, grinding, and instruments. Methods described for recording the sections are cellulose peel, photography, and drawing. The value of reconstructions is discussed.—E.S.L.

3149 **Aldrich, Charles Allen.** Study of near surface elastic–anelastic layers [abs.]: Dissert. Abs., v. 26, no. 3, p. 1579, 1965.

Alexander, W. H., Jr. *See* Broom, M. E. 2992

3094 **Alexandrov, Eugene Alexander.** Problems of genesis of sedimentary manganese deposits [abs.]: Dissert. Abs., v. 26, no. 5, p. 2684, 1965.

2959 **Allison, Richard C.** Apical development in turritellid classification with a description of *Cristispira pugetensis* gen. et sp. nov.: Palaeontology, v. 8, pt. 4, p. 666–680, illus., table, 1965.

The generic assignment of turritellas is difficult. Morphologic criteria form the best basis for classification, the most useful being apical ontogeny. The terminology applied to apical whorls is discussed and a table summarizes several authors' usages. It is found that notational systems proposed by Marwick and Kotaka permit uniform description of apical developmental characters and provide a firm base for taxonomic differentiation. Six Gulf Coast Eocene taxa are found to belong to three separate apical types which are discussed. A new turritellid from the Eocene Raging River Formation of Washington is described and compared with the Gulf Coast taxa.—E.S.L.

3217 **Almy, Charles Coit, Jr.** Parguera Limestone, Upper Cretaceous Mayagüez Group, southwest Puerto Rico [abs.]: Dissert. Abs., v. 26, no. 6, p. 3241, 1965.

Alper, Allen M. *See* Zeller, Robert A., Jr. 3006

2758 **Andersen, Svend T.** Mounting media and mounting techniques, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 587–598, tables, 1965.

Both liquid and solid mounting media are described and the size of grain mounted in certain types is listed. Special techniques for single grain and double cover-glass slides, and for measurement of large pollen grains are given. Staining and sealing techniques are also included.—E.S.L.

2954 **Anderson, D. L.** Earth's viscosity: Science, v. 151, no. 3708, p. 321–322, illus., 1966.

Elasticity and anelasticity of the Earth now are being determined by seismic methods. Seismic anelasticity varies by several orders of magnitude throughout the mantle. The ratio of viscosity to seismic anelasticity is roughly a constant, at least in the upper mantle. The ability of the Earth to deform differs markedly between the upper and lower mantle. The difference in behavior at this interface coupled with the changing angular velocity of the Earth, may be a mechanism for concentrating earthquakes at this depth.—G.R.S.

3041 **Anderson, F. D.** Geology, Belleoram, Newfoundland: Canada Geol. Survey Prelim. Ser. Map 8–1965, scale 1:253,440, text, 1965.

The Belleoram area contains rocks of two structural provinces, separated by the Terrenceville fault along and northeast from the head of Fortune Bay. To the southeast of this fault lie Precambrian rocks, chiefly volcanic and sedimentary, with some remnants of Cambrian shales and limestones. West of the main fault most of the rocks are Cambrian to Devonian clastic sediments and acidic to basic volcanic rocks. There were several periods of granitic intrusion in the map area. Most of the rock units and fold axes have a northeasterly trend. Mineral deposits include molybdenite, fluorite, copper, lead, and zinc.—M.C.M.

3218 **Anderson, Jay Earl, Jr.** Igneous geology of the central Davis Mountains, Jeff Davis County, Texas [abs.]: Dissert. Abs., v. 26, no. 6, p. 3241–3242, 1965.

3125 **Anderson, Norman Roderick.** Upper Cenozoic stratigraphy of the Oreana, Idaho, 15′ quadrangle [abs.]: Dissert. Abs., v. 26, no. 4, p. 2131, 1965.

3080 **Andrews, J. T.** Glacial geomorphological studies on north-central Baffin Island, Northwest Territories, Canada: Ottawa, Canada Dept. Mines and Tech. Surveys, Geog. Br., V. 1, p. 1–168, illus.; V. 2, p. 169–476, illus., tables, 1965.

This paper discusses: (1) the physical milieu, and the aims and methods of research; (2) systematic studies, including till fabric of cross-valley moraines, surface boulder orientations around the northwest margin of the Barnes Icecap, and application of lichenometry to glacial geomorphology; and (3) glacial chronology, beginning with the Flitaway Interglacial at 40,000 B.P., followed by the Foxe Glaciation, and the Steensby Interstadial at 19,000 B.P. Moraines indicating later advances, and the late-glacial marine transgressions are described. Land uplift is still continuing. The recent history of the Barnes Icecap and Lewis Glacier are given. A final section contains conclusions, and appendixes of the petrologic techniques.—E.S.L.

2916 **Ardmore Geological Society.** South-north cross section—N. E. corner Montague Co., Tex., to Springer, Carter Co., Okla.: Ardmore, Okla., Ardmore Geol. Soc., 1965.

2789 **Arnold, Zach M.** An improved instrument for sectioning microfossils, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 232–238, illus., 1965.

Improvements in the design and construction of the precision sectioning instrument are listed and described. Procedure used in sectioning a specimen is given.—E.S.L.

2810 **Arnold, Zach M.** The use of plastics in paleontology, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 420–422, illus., 1965.

Plastics are relatively easy to work, and the many different types cover a wide range of applications. Simple apparatus for the techniques of compression, injection, and extrusion are described. Examples of uses of plastics in paleontology, using these simple techniques and primitive equipment, are given.—E.S.L.

2794 **Arnold, Zach M.** The centrifuge as a tool in foraminiferal preparation, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 258–261, illus., 1965.

The centrifuge apparatus and methods described have been developed to permit handling any quantity of specimens with speed and efficiency and without the loss of a single individual throughout a complicated sequence of fluid changes.—E.S.L.

2795 **Arnold, Zach M.** The vacuum oven for impregnating microfossils, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 262–263, illus., 1965.

A vacuum oven for use in infiltrating the tests of foraminifera or other microfossils with synthetic resins prior to sectioning is illustrated and described.—E.S.L.

2922 **Atlantic Coastal Plain Geol. Assoc.; Colquhoun, Donald J.** Terrace sediment complexes in central South Carolina—Field conference 1965: Columbia, S. C., Univ. South Carolina, 62 p., illus., tables, 1965.

During this field investigation, ten terraces have been noted. At least two others are known to exist widely. Not all mapped terraces are underlain by unique transgressive–regressive stratigraphic sequences. More than one terrace can result from one sequence. Eight sequences have been indicated to date. Others are suspected but not proved. The transgressive–regressive units are bounded above by terrestrial and marine landforms and below by terrestrial and marine unconformities. Between these surfaces occur sequential and gradational lithofacies, biofacies, and paleoecologic eoseres of Coastal Plain and continental shelf environments. Not all terraces nor the formations determined to date are Pleistocene. The higher features are apparently much older.—*from* Authors' abstract

2982 **Atlantic Coastal Plain Geol. Assoc.; Heron, S. Duncan, Jr.; Wheeler, Walter H.** The Cretaceous formations along the Cape Fear River, North Carolina—5th annual field excursion, Oct. 1964: [Durham, N. C., Duke Univ.] 53 p., illus., 1964.

The stratigraphic relations, lithology, sedimentary structures, and clay mineralogy of the basal Cretaceous Cape Fear, Middendorf, Black Creek, and Peedee Formations are studied. Fossil lists are included.—E.S.L.

2972 **Atwater, Gordon I.** The effect of decrease in porosity with depth on oil and gas reserves in sandstone reservoirs [abs.]: Houston Geol. Soc. Bull., v. 8, no. 6, p. 20, 1966.

3337 **Auffenberg, Walter; Milstead, William W.** Reptiles in the Quaternary of North America, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 557–568, illus., tables, 1965.

The main effects of the Quaternary on reptiles were those changes in range resulting from fluctuating ecology, along with some speciation, principally at the subspecies level, and some extinction. The groups most affected were the tortoises. Humidity changes made alternating arid and mesic routes that brought about mixing of eastern and western herpetofaunal elements, and left relict populations.—E.S.L.

Aughenbaugh, N. B. *See* West, T. R. 2879

3065 **Badgley, Peter C.** Structural and tectonic principles: New York, Harper and Row, Publishers, 521 p., illus., tables, 1965.

Principles of structural geology are related to, and integrated with, such larger fields as tectonics, crustal evolution, tectonophysics, oceanography, and planetology. Emphasis is on structural problems of foothill belts and their application in the search for petroleum; regional analysis of structural patterns and the application to the discovery of ore deposits; and synthesis of geophysical and tectonic information to provide a better understanding of the crustal evolution of the world's mountain systems. Many North American examples are used. The text is written

primarily for undergraduate students, however adequate depth is provided for first-year graduate students. Over 400 illustrations are included.—E.S.L.

3030 **Baker, E. T., Jr.** Ground-water resources of Jackson County, Texas: Texas Water Devel. Board Rept. 1, 225 p., illus., tables, 1965.

Ground water occurs in thick sequences of Tertiary and Pleistocene sand and gravel, which function as the Gulf Coast aquifer. Levels are declining at an average rate of about 1.5 ft per yr, and land subsidence, not exceeding 6 in. at most places, is occurring as a consequence. There is some contamination in areas near oil and gas fields. The 1963 rate of withdrawal probably can be maintained indefinitely. Chemical analyses of water, and drillers' logs of wells are included.—E.S.L.

Bandy, Orville L. *See* Merriam, Richard. 3174

2936 **Barker, R. Wright.** Notes on Miogypsinidae in the Gulf of Mexico region, *in* Dr. D. N. Wadia Commemorative Volume: Calcutta, India, Mining, Geol. and Metall. Inst. India, p. 306–342, illus., 1965.

The historical background of study of the family Miogypsinidae is reviewed briefly, with discussion of classification and evolutionary trends. Twelve species are described from the upper Tertiary of the Gulf of Mexico region and their relationships and stratigraphic distribution are shown diagrammatically. Ranging from late Oligocene to possibly middle Miocene, the designations of age vary according to author because of the controversial position of the Oligocene–Miocene boundary. Primitive forms with rotaloid early stages occur in older beds and grade in lower Miocene into forms lacking rotaloid commencement and with subcentral embryonic chambers. Though rare in the Gulf Coast, *Miogypsina* is regarded as a valuable indicator for correlation.—*from* Author's abstract

3140 **Barnard, Walter M.** Solubilities of selected chalcophile elements in hydrothermally synthesized β-ZnS (sphalerite) [abs.]: Dissert. Abs., v. 26, no. 4, p. 2245, 1965.

2929 **Barnes, H. L.** Environmental limitations to mechanisms of ore transport, *in* Symposium—Problems of postmagmatic ore deposition with special reference to the geochemistry of ore veins, Prague, 1963, V. 2: Prague, Geol. Survey of Czechoslovakia, p. 316–326, illus., 1965; reply to discussion by H. D. Holland, ibid., p. 456–457, 1965.

General limits are delineated to the chemical environment during formation of epigenetic base-metal deposits on the basis of pertinent mineralogic associations of specific ores. The fundamental chemical mechanism of transport of any one metal is considered to be the same regardless of the type of deposit. From stabilities of minerals associated with each deposit, the acidity of the ore-transporting solution is shown to range between weakly acidic and moderately alkaline. Because sulfides are not significantly soluble in weakly acidic hydrogen sulfide solutions, the ore-transporting fluid must be neutral to moderately alkaline, and also a sulfide rich strongly-reducing brine. Base-metal sulfides appear soluble in bisulfide complexes to at least 200°C, which seems compatible with geologic requirements.—M.C.

Barr, David J. *See* West, Terry R. 3084

3219 **Barsdate, Robert John.** The biogeochemistry of molybdenum in lakes and in the sea [abs.]: Dissert. Abs., v. 26, no. 6, p. 3242, 1965.

3321 **Bates, Robert G.** Aeroradioactivity survey and areal geology of the National Reactor Testing Station area, Idaho (ARMS-1): U.S. Atomic Energy Comm. Rept. CEX-59.4.10, 22 p., illus., 1965.

The area includes parts of the Northern Rocky Mountains province, the Snake River Plain section of the Columbia Plateaus province, and the Great Basin section of the Basin and Range province. In those parts flown, silicic volcanic Tertiary rocks have radioactivity levels as high as 2100 cps. On the Snake River Plain levels ranged from 200–1600 cps and averaged about 600–800 cps. Delineation of some Recent lava flows by the radioactivity data is excellent. Increase in radioactivity level toward

the center of a lava flow may be indicative of successive flows from a differentiating magma source. The radioactivity level of blocky lava flows is 50–100 cps higher than that of adjacent ropy flows; this is probably due to a greater emitting surface area per unit volume on the blocky flows.—*from* Author's abstract

3165 **Batjes, D. A. J.** Paleoecology of foraminiferal assemblages in the late Miocene Cruse and Forest Formations of Trinidad, West Indies [abs.]: Bol. Inf., v. 8, no. 3, p. 75, 1965.

2832 **Bayley, Richard W.** Geologic map of the Miners Delight quadrangle, Fremont County, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ-460, scale 1:24,000, section, 1965.

Bayne, C. K. *See* Reed, E. C. 3251

Bé, Allan W. H. *See* Krinsley, David. 2883

3144 **Beard, William Clarence.** Phase relations in the systems titania and titania–boric oxide [abs.]: Dissert. Abs., v. 26, no. 4, p. 2245–2246, 1965.

2913 **Behre, Charles H., Jr.; Rouse, John T.** Walter Herman Bucher [1888–1965]: Am. Geophys. Union Trans., v. 46, no. 4, p. 637–638, portrait, 1965.

2957 **Bender, M. L.; Ku, Teh-Lung; Broecker, W. S.** Manganese nodules—Their evolution: Science, v. 151, no. 3708, p. 325–328, illus., 1966.

That manganese nodules and adjacent deep-sea sediments are accumulating manganese at almost the same rate has been established by thorium-230 dating of both sediments and nodules of known manganese content. The rate of manganese deposition is nearly constant over the world oceans. A relatively simple model of nodule evolution explains the distribution of manganese nodules between sediment column and sediment–water interface; the model appears to apply to other trace elements such as copper, nickel, and cobalt.—Authors' abstract

2813 **Benson, Richard H.** Photography of microfossils, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 433–446, illus., 1965.

The purpose of this paper is to examine some of the more successful methods of photographing microfossils in the size range of foraminifers, ostracods, and conodonts. Most of the difficulties encountered in using conventional apparatus is discussed. Particular attention is paid to obtaining adequate depth of field, preparing the fossil to reveal the surface morphology, and lighting the specimen for photography in reflected light. Practical procedures are stressed.—*from* Author's introduction

3291 **Berg, Dennis W.** Factors affecting beach nourishment requirements at Presque Isle Peninsula, Erie, Pennsylvania, *in* Conf. on Great Lakes Research, 8th, Ann Arbor, 1965, Proc.: Michigan Univ. Great Lakes Research Div. Pub. 13, p. 214–221, illus., 1965.

Analysis of available data on Presque Isle Peninsula, Erie, Pa., indicates apparent correlation of initial high erosion rates of placed beach fill with sand size characteristics of the fill and the mean level of Lake Erie for the period over which measured losses occur. Although erosion of the fill has been more than anticipated, the data indicate that nourishment requirements for replenishing the beaches, should decrease as the beach profiles become readjusted through selective sorting of the fill material to incident wave forces reaching the peninsula.—Author's abstract

3240 **Berkebile, Charles Alan.** Growth and properties of transition metal monoxide crystals [abs.]: Dissert. Abs., v. 26, no. 6, p. 3385–3386, 1965.

3313 **Bernard, Hugh A.; LeBlanc, Rufus J.** Résumé of the Quaternary geology of the northwestern Gulf of Mexico province, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 137–185, illus., 1965.

The Quaternary coastal plain consists of four Pleistocene surfaces and related formations, and a Recent surface and associated deposits. The Recent plain is only a few feet above sea level and is underlain mostly by deltaic and interdeltaic deposits. Recent and Pleistocene sediments are separated by a prominent unconformity. Each Pleistocene surface is underlain by sequences of sediments which grade from largely continental into deltaic and marine facies. The sequences are unconformable. Stages are determined by sea-level changes and are thus correlated with glacial stages. Physiographic features have been grouped into three types: those resulting from deposition, from erosion, and from tectonics. Under the first type, the most common forms are classified and described in detail. The other types are discussed briefly. Geologic and geomorphic sketch maps, sections, and fence diagrams illustrate the discussion.—E.S.L.

3008 **Berry, L. G.** James Edwin Hawley, 1897–1965: Royal Soc. Canada Minutes Proc., 4th ser., v. 3, p. 107–108, portrait, 1965.

2773 **Berry, William B. N.** Graptolites, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 103–109, 1965.

Most Graptolithina are flattened and need little special treatment, but the complexities of graptolite morphology must be worked out primarily from uncrushed specimens freed from their matrix. Suggestions on collecting are given. Preparation techniques are divided between flattened and unflattened material, with special attention to clearing and mounting of freed specimens, and preparation of branching specimens. Graptolite illustration has always been a problem, but photographs are the most satisfactory.—E.S.L.

2940 **Bird, Samuel O.** Upper Tertiary Arcacea of the Mid Atlantic Coastal Plain: Palaeontographica Americana, v. 5, no. 34, 62 p., illus., tables, 1965.

The upper Tertiary stratigraphy of Maryland, Virginia, and North Carolina is reviewed, and a list of gastropod and pelecypod species from 22 localities of stratigraphic importance is given. These lists are statistically analyzed by the Rogers–Tanimoto method, and the stratigraphic significance discussed. The systematic relationships of species in the genera *Anadara*, *Noetia*, and *Glycymeris* are studied with the aid of bivariate analysis. Tables of raw measurement data are appended.—E.S.L.

2848 **Bird, W. E.** Geophysical history, Brehm field, Pratt County, Kansas: Geophysics, v. 30, no. 6, p. 1008–1025, illus., 1965.

The Brehm field, Pratt County, Kans., was discovered in October, 1961, after a detailed seismic survey following a subsurface lead. Developed production is from the Arbuckle, Simpson, and Lansing. Production to date is about three hundred thousand bbl of oil plus about one billion cu ft of gas. Estimated reserves are four to six million bbl. of oil.—Author's abstract

Birman, J. H. *See* Wahrhaftig, Clyde. 3254

Black, Robert F. *See* Frye, John C. 3245

3307 **Blair, W. Frank.** Amphibian speciation, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 543–556, illus., 1965.

Amphibian speciation was initiated by Pleistocene climatic changes. Some distribution patterns have existed since the Tertiary, but most seem to have had their origins in the Pleistocene. Distribution maps of several species are given. Southern disjunct populations reflect southward displacement. Northern disjuncts are rare. East–west disjuncts reflect glacial–interglacial climatic changes.—E.S.L.

Blanchard, F. B. *See* Radbruch, Dorothy H. 2980

3015 **Blank, Horace R.; Tynes, Eugene W.** Formation of caliche *in situ*: Geol. Soc. America Bull., v. 76, no. 12, p. 1387–1392, illus., 1965.

A study of caliche in Kimble County, Tex., concludes that most was produced by transformation and replacement of limestone *in situ* and not by migrating water. Small folds and collapse structures associated with the caliche appear to be the result of expansion accompanying the hydration process.—R.G.Y.

Bonilla, M. G. *See* Radbruch, Dorothy H. 2980

Borcsik, Maria. *See* Holland, H. D. 2947

3166 **Bower, T. H.** Geology of Forest Reserve Oilfield, Trinidad, West Indies [abs.]: Bol. Inf., v. 8, no. 3, p. 76, 1965.

2971 **Bowles, R. C.** Maynard Herman Steig (1904–1965): Houston Geol. Soc. Bull., v. 8, no. 6, p. 19, portrait, 1966.

2937 **Boyle, R. W.** The geochemistry of arsenic, Keno Hill–Galena Hill area, Yukon, Canada, *in* Dr. D. N. Wadia Commemorative Volume: Calcutta, India, Mining, Geol. and Metall. Inst. India, p. 757–770, illus., tables, 1965.

In the country rock of this area arsenic is most abundant in the graphitic argillites, schists, and phyllites, the bulk of it carried in pyrite. In this second stage mineralization of the area arsenic is concentrated in arseno-pyrite; in the third stage siderite-galena-sphalerite-pyrite lodes, small amounts occur in pyrite and freibergite. Oxidation of the lodes has led to the formation of scorodite, beudanite, and pharmacosiderite—all the result of a series of complex oxidation, hydrolytic, co-precipitation, and adsorption reactions. The oxidized zones of some veins are slightly enriched in arsenic; others are depleted. Zones of reduction show a small enrichment where marcasite, secondary pyrite, and pyrargyrite are abundant.—*from* Author's abstract

3261 **Boynton, G. R.; Smith, C. W.** Aeromagnetic map of the Jewett City quadrangle, New London County, Connecticut: U.S. Geol. Survey Geophys. Inv. Map GP-539, scale 1:24,000, 1965.

3262 **Boynton, G. R.; Smith, C. W.** Aeromagnetic map of the Scotland quadrangle, Windham and New London Counties, Connecticut: U.S. Geol. Survey Geophys. Inv. Map GP-540, scale 1:24,000, 1965.

3263 **Boynton, G. R.; Smith, C. W.** Aeromagnetic map of the Plainfield quadrangle, New London and Windham Counties, Connecticut: U.S. Geol. Survey Geophys. Inv. Map GP-541, scale 1:24,000, 1965.

3264 **Boynton, G. R.; Smith, C. W.** Aeromagnetic map of the Oneco quadrangle, Connecticut and Rhode Island: U.S. Geol. Survey Geophys. Inv. Map GP-542, scale 1:24,000, 1965.

3265 **Boynton, G. R.; Smith, C. W.** Aeromagnetic map of the Norwich quadrangle, New London County, Connecticut: U.S. Geol. Survey Geophys. Inv. Map GP-543, scale 1:24,000, 1965.

3266 **Boynton, G. R.; Smith, C. W.** Aeromagnetic map of the Old Mystic quadrangle and part of the Mystic quadrangle, Connecticut and Rhode Island: U.S. Geol. Survey Geophys. Inv. Map GP-544, scale 1:24,000, 1965.

3267 **Boynton, G. R.; Smith, C. W.** Aeromagnetic map of the Voluntown quadrangle, Connecticut and Rhode Island: U.S. Geol. Survey Geophys. Inv. Map GP-545, scale 1:24,000, 1965.

3268 **Boynton, G. R.; Smith, C. W.** Aeromagnetic map of the Uncasville quadrangle and part of the New London quadrangle, New London County, Connecticut: U.S. Geol. Survey Geophys. Inv. Map GP-546, scale 1:24,000, 1965.

3269 **Boynton, G. R.; Smith, C. W.** Aeromagnetic map of the Ashaway quadrangle and part of the Watch Hill quadrangle, Connecticut and Rhode Island: U.S. Geol. Survey Geophys. Inv. Map GP-547, scale 1:24,000, 1965.

3062 **Bragg, Lawrence; Claringbull, G. F.** The crystalline state—V. 4, Crystal structure of minerals: Ithaca, N. Y., Cornell Univ. Press, 409 p., illus., tables, revised 1965; originally published 1937.

This book is a revision of "Atomic structure of minerals," published in 1937. The body of work on minerals is now so vast that it is no longer possible to achieve a complete account in a reasonable space. Therefore, the investigations of the more common and important minerals, and those with particularly interesting structures are described. At the end of each chapter is listed key references to all the other structures traced to the end of 1963. An appendix lists space groups, and indexes for both mineral names and chemical formulae are given.—E.S.L.

2912 **Branson, Carl C.** *Serpula* in the Caddo Limestone of Choctaw County: Oklahoma Geology Notes, v. 25, no. 12, p. 300–301, illus., 1965.

The specimen, cemented to the surface of an echinoid, was collected from the Cretaceous Caddo Limestone along the bank of Bokchito Creek. It is referred with doubt to *S. cragini*.—E.S.L.

2934 **Branson, Carl C.** Selective effect of fifty year rule on names of Late Paleozoic fossils in the Indian region, *in* Dr. D. N. Wadia Commemorative Volume: Calcutta, India, Mining, Geol. and Metall. Inst. India, p. 226–230, 1965.

The Code of Zoological Nomenclature (1961) provides that names not used for a period of more than 50 years are forgotten names and are not to be used again. If strictly enforced the rule would selectively eliminate a great proportion of names of Late Paleozoic fossils, especially from India and Australia.—Author's abstract

3082 **Brideaux, W. W.** A double layer mounting technique for aqueous palynological residues: Jour. Paleontology, v. 40, no. 1, p. 226, 1966.

The corn syrup method of making slide mounts of aqueous palynological residues is improved upon by using *Permount* as a permanent sealant. This method also retains the advantages of using a water miscible medium.—S.H.M.

3175 **Briggs, Louis I.** Heavy mineral correlations and provenances: Jour. Sed. Petrology, v. 35, no. 4, p. 939–955, illus., 1965.

Heavy mineral fractions from four Tertiary formations in Huerfano Park, Colorado, were tested statistically to see if they supported the conclusions on mode of deposition, direction of transport, and local source areas based on observable field relations. Theoretical modal size separation was also tested. Conclusions were: that the formations cannot be identified by heavy mineral composition, that interpretation of a heavy mineral correlation matrix could identify sediment from Precambrian crystalline sources and from Pennsylvanian Permian sedimentary sources, and that statistical visual clustering and factor analysis could also differentiate different source material. Source rock characteristics caused departures from expected size frequency modes.—R.A.C.

Brisbin, W. C. *See* Hall, D. H. 2850

2956 **Broecker, W. S.** Absolute dating and the astronomical theory of glaciation: Science, v. 151, no. 3708, p. 299–304, illus., 1966.

A simple hypothesis explains the major features of the climatic chronology for the past 200,000 years. A previous concept of fluctuations about a mean climate in response to changes in insolation is modified by assuming that the ocean–atmosphere system has two stable states or modes, glacial and interglacial; that rapid transitions between these states are triggered by the larger insolation peaks; and that fluctuations about these states occur in response to insolation changes not large enough to cause mode transitions. The hypothesis explains the timing of observed fluctuations in oceanic climate, the prominent ice maxima, and the high stands of the sea that have occurred in the last 200,000 years, and which are amenable to absolute dating.—G.R.S.

Broecker, W. S. *See* Bender, M. L. 2957

Broecker, Wallace S. *See* Ku, Teh-Lung. 2953

3305 **Broecker, Wallace S.** Isotope geochemistry and the Pleistocene climatic record, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 737–753, illus., tables, 1965.

The current status of isotope techniques employed for the determination of Pleistocene chronology and climate is summarized. Results derived from the application of these methods are evaluated. The conclusion is drawn that a generally reliable climatic record for the past 150,000 years has been obtained and that this record bears a remarkable resemblance to that predicted by Milankovitch type insolation curves.—Author's abstract

2962 **Brokaw, Arnold L.; Heidrick, Tom.** Geologic map and sections of the Giroux Wash quadrangle, White Pine County, Nevada: U.S. Geol. Survey Geol. Quad. Map GQ-476, scale 1:24,000, 1966.

2781 **Brooks, H. K.** Underwater paleontological collecting techniques, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 168–175, 1965.

Gear and methods are discussed in four categories: oceanographic, devices of the civil engineer (cofferdams, caissons, etc.), swimming and diving, and robots. Most of the paper is devoted to the third category, especially as used in springs and sinkholes in Florida.—E.S.L.

2827 **Brooks, H. K.** Arthropods with chitinous exoskeletons, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 64–75, 1965.

Special environmental conditions are required for the entombment and preservation of arthropods with only chitinous skeletal materials. New and unique arthropods will continue to be unearthed, as our known fossils are but a poor sample of the multitudes of species that have existed during the past. The preservation and stratigraphic occurrence of chitinous remains is discussed. Preparation techniques described include splitting, hand tooling, molds and casts, chemical preparation, and polished surfaces and thin sections.—E.S.L.

2992 **Broom, M. E.; Alexander, W. H., Jr.; Myers, B. N.** Groun-water resources of Camp, Franklin, Morris, and Titus Counties, Texas: Texas Water Comm. Bull. 6517, 153 p., illus., tables, 1965.

In this four-county area the principal sources of ground water are the Wilcox Group and Carrizo Sand, Reklaw Formation, and Queen City Sand of the Claiborne Group, which are probably inter-connected hydraulically and function as a single aquifer called the "Cypress aquifer." Its thickness ranges from zero to about 1,200 feet; about half its volume is sand in which almost all the water is contained. Because of the abundance of surface water, the low transmissibility of the aquifer, and the iron and acid-water problems, not much development of the Cypress is anticipated in the near future.—M.C.M.

2979 **Broughton, Paul.** The origin of tektites, Pt. 1: Earth Sci., v. 19, no. 1, p. 18–22, illus., 1966.

The various theories for the origin of tektites are summarized for the non-technical reader and pro and con arguments are presented for each.—M.C.M.

Brown, C. Ervin. *See* Thayer, T. P. 2967

Brown, Jerry. *See* Sellman, Paul V. 2910

Brown, S. G. *See* Kister, L. R. 3087

Brown, S. R. *See* Millson, M. F. 3050

3322 **Buddington, A. F.** The origin of three garnet isograds on Adirondack gneisses: Mineralog. Mag., v. 34, no. 268, p. 71–81, illus., table, 1965.

Three isograds may be drawn, indicating increasing grades of metamorphism in the northern Adirondack area, based on development of garnet successively in biotite–quartz–plagioclase paragneiss, metadolerite and metagabbro gneiss, and syenite and quartz syenite orthogneisses. Changes in accompanying minerals show that this is an order of increasing temperature. Rocks of similar chemical composition, suitable for development of garnet, occur in each grade of metamorphism and geologic studies indicate adequate temperature and depth for development of garnet even where it is not present. Data are consistent with an hypothesis that successive development of a garnetiferous facies for each different gneiss required special conditions that facilitated kinetics of the reaction, such as temperature in excess of that for equilibria, in order for the garnet reaction to proceed.—*from* Author's abstract

3067 **Bullard, Edward; Everett, J. E.; Smith, A. Gilbert.** The fit of continents around the Atlantic, *in* A symposium on continental drift: Royal Soc. London Philos. Trans., ser. A, v. 258, no. 1088, p. 41–51, illus., 1965.

This paper describes fits made by numerical methods, with a least squares criterion for the continents around the Atlantic Ocean. The best fit is found to be at the 500-fathom contour, which lies on the steep part of the continental edge. The rms errors for the Africa–South America, Greenland–Europe, and North America–Greenland fits are 30–90 km, and are thought not to be due to chance. The fit of the South America–Africa block to the Europe–North America–Greenland block is much poorer (rms misfit = 130 km). These geometric fits are regarded as preliminary to a comparison of the stratigraphy, structures, ages, and paleomagnetic results across the joins.—D.B.V.

3095 **Burkart, Burke.** Geology of the Esquipulas, Chanmagua and Cerro Montecristo quadrangles, southeastern Guatemala [abs.]: Dissert. Abs., v. 26, no. 5, p. 2684–2685, 1965.

2771 **Burma, Benjamin H.** Radiolarians, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 7–14, 1965.

The method discussed here was developed to obtain radiolarians from indurated tuffs, which break down with difficulty. Rocks more easily broken down can be treated more gently and some of the directions abbreviated or possibly omitted. The method is presented in more detail than is usual. Preparation methods for both strews and picked slides are given.—E.S.L.

3096 **Burns, Roger George.** Electronic spectra of silicate minerals—Application of crystal-field theory to aspects of geochemistry [abs.]: Dissert. Abs., v. 26, no. 5, p. 2685, 1965.

3077 **Busch, Fred E.** Ground-water levels in New Mexico, 1964—Basic data report: Santa Fe, N. Mex., New Mexico State Engineer, 130 p., illus., tables, 1966.

Annual measurements of water levels in observation wells in various areas in New Mexico, and in a small part of south central Colorado, in January, February, and March 1965, and changes in water levels since January, February, or March 1964, are tabulated in this report; seasonal and daily measurements from recorder charts in 1964 also are included. Water-level changes for 1964 are presented graphically on maps for most areas of observation. . . .—Author's abstract

2998 **Buschbach, T. C.** Deep stratigraphic test well near Rock Island, Illinois: Illinois Geol. Survey Circ. 394, 20 p., illus., table, 1965.

Exploration for underground gas storage reservoirs resulted in the drilling of a deep stratigraphic test well about 10 miles south of Rock Island, Ill. Radioactivity,

electrical, and sonic logs, with a description of cores and samples from the well, provide information not available previously about the sequence of deeper strata in the region. Precambrian rocks were encountered at a depth of 3,855 feet. Possible reservoirs for gas storage were found in the St. Peter, Ironton–Galesville, and Mt. Simon Sandstones.—Author's abstract

Buschman, William J., Jr. *See* Norling, Donald L. 2903

3126 **Bushnell, Kent Orpha.** The geology of the Rowland quadrangle, Nevada [abs.]: Dissert. Abs., v. 26, no. 4, p. 2131–2132, 1965.

3010 **Byers, A. R.** James Buckland Mawdsley, 1894–1964: Royal Soc. Canada Minutes Proc., 4th ser., v. 3, p. 131–132, portrait, 1965.

2849 **Campbell, Francis P.** Fault criteria: Geophysics, v. 30, no. 6, p. 976–997, illus., 1965.

Six criteria for fault interpretation of seismic data in East Texas and the Gulf coast are illustrated by a series of maps and cross sections: *correlation* of reflecting horizons which bracket the producing objective; *projection* of a fault from a shallow bed with correlatable reflections to a deep producing objective; *variation* between geologic correlations and geophysical dips; *microclosure* around a grid unit of seismic control; *dip pattern* along several lines of control; and *diffraction*. The diffraction example includes results of model experiments in the laboratory. Fault interpretation usually depends on a combination of several criteria, and additional criteria may be used. The criteria presented here are not infallible and do not detect very small faults.—D.B.V.

2893 **Canada Geological Survey.** Aeromagnetic map, McAdam Lake, Saskatchewan: Canada Geol. Survey Geophysics Paper 2828, scale 1:63,360, 1965.

3339 **Canada Geological Survey.** Aeromagnetic map, Edmundston, New Brunswick: Canada Geol. Survey Geophysics Paper 4006, scale 1:63,360, 1965.

3340 **Canada Geological Survey.** Aeromagnetic map, Grandmaison, New Brunswick: Canada Geol. Survey Geophysics Paper 4007, scale 1:63,360, 1965.

3341 **Canada Geological Survey.** Aeromagnetic map, Wild Goose Lake, New Brunswick: Canada Geol. Survey Geophysics Paper 4008, scale 1:63,360, 1965.

3342 **Canada Geological Survey.** Aeromagnetic map, Lac Baker, New Brunswick: Canada Geol. Survey Geophysics Paper 4009, scale 1:63,360, 1965.

3343 **Canada Geological Survey.** Aeromagnetic map, Eastport, New Brunswick–Nova Scotia: Canada Geol. Survey Geophysics Paper 7033, scale 1:253,440, 1965.

3344 **Canada Geological Survey.** Aeromagnetic map, Amherst, New Brunswick–Nova Scotia: Canada Geol. Survey Geophysics Paper 7036, scale 1:253,440, 1965.

3345 **Canada Geological Survey.** Aeromagnetic map, Fredericton, New Brunswick: Canada Geol. Survey Geophysics Paper 7037, scale 1:253,440, 1965.

3346 **Canada Geological Survey.** Aeromagnetic map, Charlottetown, Prince Edward Island–New Brunswick: Canada Geol. Survey Geophysics Paper 7039, scale 1:253,440, 1965.

3347 **Canada Geological Survey.** Aeromagnetic map, Moncton, New Brunswick–Prince Edward Island: Canada Geol. Survey Geophysics Paper 7040, scale 1:253,440, 1965.

3348 **Canada Geological Survey.** Aeromagnetic map, Woodstock, New Brunswick: Canada Geol. Survey Geophysics Paper 7041, scale 1:253,440, 1965.

3349 **Canada Geological Survey.** Aeromagnetic map, Magdalen Islands, Nova Scotia–Quebec: Canada Geol. Survey Geophysics Paper 7043, scale 1:253,440, 1965.

3350 **Canada Geological Survey.** Aeromagnetic map, Bradelle Bank, Prince Edward Island–Quebec: Canada Geol. Survey Geophysics Paper 7044, scale 1:253,440, 1965.

3351 **Canada Geological Survey.** Aeromagnetic map, Bathurst, New Brunswick–Prince Edward Island: Canada Geol. Survey Geophysics Paper 7045, scale 1:253,440, 1965.

3352 **Canada Geological Survey.** Aeromagnetic map, Campbellton, New Brunswick: Canada Geol. Survey Geophysics Paper 7046, scale 1:253,440, 1965.

3353 **Canada Geological Survey.** Aeromagnetic map, Revelstoke–Kootenay, Kamloops and Osoyoos Districts, British Columbia: Canada Geol. Survey Geophysics Paper 2651, scale 1:63,360, 1965.

3354 **Canada Geological Survey.** Aeromagnetic map, Butterfly Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2604, scale 1:63,360, 1965.

3355 **Canada Geological Survey.** Aeromagnetic map, Sheet 63 I/11, Manitoba: Canada Geol. Survey Geophysics Paper 2605, scale 1:63,360, 1965.

3356 **Canada Geological Survey.** Aeromagnetic map, Whiterabbit Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2606, scale 1:63,360, 1965.

3357 **Canada Geological Survey.** Aeromagnetic map, Bulger Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2607, scale 1:63,360, 1965.

3358 **Canada Geological Survey.** Aeromagnetic map, Landing Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2608, scale 1:63,360, 1965.

3359 **Canada Geological Survey.** Aeromagnetic map, Pikwitonei, Manitoba: Canada Geol. Survey Geophysics Paper 2609, scale 1:63,360, 1965.

3360 **Canada Geological Survey.** Aeromagnetic map, Begg Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2610, scale 1:63,360, 1965.

3361 **Canada Geological Survey.** Aeromagnetic map, Cotton Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2611, scale 1:63,360, 1965.

3362 **Canada Geological Survey.** Aeromagnetic map, Prudhomme Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2612, scale 1:63,360, 1965.

3363 **Canada Geological Survey.** Aeromagnetic map, Armstrong Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2613, scale 1:63,360, 1965.

3364 **Canada Geological Survey.** Aeromagnetic map, Arnot, Manitoba: Canada Geol. Survey Geophysics Paper 2614, scale 1:63,360, 1965.

3365 **Canada Geological Survey.** Aeromagnetic map, Allbright Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2615, scale 1:63,360, 1965.

3366 **Canada Geological Survey.** Aeromagnetic map, Goulet Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2616, scale 1:63,360, 1965.

3367 **Canada Geological Survey.** Aeromagnetic map, Bearhead Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2617, scale 1:63,360, 1965.

3368 **Canada Geological Survey.** Aeromagnetic map, Gunn Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2618, scale 1:63,360, 1965.

3369 **Canada Geological Survey.** Aeromagnetic map, Dobbs Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2619, scale 1:63,360, 1965.

3370 **Canada Geological Survey.** Aeromagnetic map, Cuddle Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2620, scale 1:63,360, 1965.

3371 **Canada Geological Survey.** Aeromagnetic map, High Hill Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2621, scale 1:63,360, 1965.

3372 **Canada Geological Survey.** Aeromagnetic map, War Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2622, scale 1:63,360, 1965.

3373 **Canada Geological Survey.** Aeromagnetic map, Whitemud Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2623, scale 1:63,360, 1965.

3374 **Canada Geological Survey.** Aeromagnetic map, Schwatka Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2624, scale 1:63,360, 1965.

3375 **Canada Geological Survey.** Aeromagnetic map, Sheet 53 M/11, Manitoba: Canada Geol. Survey Geophysics Paper 2625, scale 1:63,360, 1965.

3376 **Canada Geological Survey.** Aeromagnetic map, Sheet 53 M/14, Manitoba: Canada Geol. Survey Geophysics Paper 2626, scale 1:63,360, 1965.

3377 **Canada Geological Survey.** Aeromagnetic map, Parker Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2627, scale 1:63,360, 1965.

3378 **Canada Geological Survey.** Aeromagnetic map, Sheet 53 M/7, Manitoba: Canada Geol. Survey Geophysics Paper 2628, scale 1:63,360, 1965.

3379 **Canada Geological Survey.** Aeromagnetic map, Sheet 53 M/10, Manitoba: Canada Geol. Survey Geophysics Paper 2629, scale 1:63,360, 1965.

3380 **Canada Geological Survey.** Aeromagnetic map, Hawes Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2630, scale 1:63,360, 1965.

3381 **Canada Geological Survey.** Aeromagnetic map, Semmens Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2631, scale 1:63,360, 1965.

3382 **Canada Geological Survey.** Aeromagnetic map, Wilsie Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2632, scale 1:63,360, 1965.

3383 **Canada Geological Survey.** Aeromagnetic map, Stupart Lake, Manitoba: Canada Geol. Survey Geophysics Paper 2633, scale 1:63,360, 1965.

3384 **Canada Geological Survey.** Aeromagnetic map, Sheet 53 M/16, Manitoba: Canada Geol. Survey Geophysics Paper 2634, scale 1:63,360, 1965.

3385 **Canada Geological Survey.** Aeromagnetic map, Riley Brook, New Brunswick: Canada Geol. Survey Geophysics Paper 3998, scale 1:63,360, 1965.

3386 **Canada Geological Survey.** Aeromagnetic map, Sisson, New Brunswick: Canada Geol. Survey Geophysics Paper 3999, scale 1:63,360, 1965.

3387 **Canada Geological Survey.** Aeromagnetic map, Kedgwick, New Brunswick: Canada Geol. Survey Geophysics Paper 4000, scale 1:63,360, 1965.

3388 **Canada Geological Survey.** Aeromagnetic map, Grand Falls, New Brunswick: Canada Geol. Survey Geophysics Paper 4002, scale 1:63,360, 1965.

3389 **Canada Geological Survey.** Aeromagnetic map, Grand River, New Brunswick: Canada Geol. Survey Geophysics Paper 4003, scale 1:63,360, 1965.

3390 **Canada Geological Survey.** Aeromagnetic map, Gounamitz River, New Brunswick: Canada Geol. Survey Geophysics Paper 4004, scale 1:63,360, 1965.

3391 **Canada Geological Survey.** Aeromagnetic map, States Brook, New Brunswick: Canada Geol. Survey Geophysics Paper 4005, scale 1:63,360, 1965.

Carr, W. J. *See* Poole, F. G. 2839

3258 **Carson, Carlton M.** The Rincon formation, *in* Western Santa Ynez Mountains, Santa Barbara County, California—Coast Geol. Soc. and SEPM Pacific Sec., Field Trip 1965, Guidebook: [n.p.] Coast Geol. Soc., p. 38–41, 1965.

The Rincon Formation is a clay shale series of lower Miocene age. Formations in part correlative with it are the Temblor, Topanga, and Soda Lake. The type section of the Rincon is given, showing zoning and Foraminifera, and the lithology discussed. Three hundred samples, each covering a 10-ft stratigraphic interval, were collected from the type section. A thrust fault causes duplication of 460 feet of beds.—E.S.L.

3097 **Carter, James Lee.** The origin of olivine bombs and related inclusions in basalts [abs.]: Dissert. Abs., v. 26, no. 5, p. 2685–2686, 1965.

3201 **Carver, Robert E.** Undulose extinction in fine-grained rocks: Jour. Sed. Petrology, v. 35, no. 4, p. 980–983, illus., 1965.

The undulose extinction commonly observed in fine-grained rocks is an optical interference produced by superposition of wedge-shaped grain fragments.—Author's abstract

3025 **Castillo M., Rolando.** Aspectos geológicos de los yacimientos de arcilla y laterita de Costa Rica: Costa Rica Dept. Geología, Minas y Petróleo Informes, v. 4, no. 16, 46 p., illus., tables, 1965.

Deposits of ordinary industrial clays and ceramic kaolins and of bauxitic laterites in Costa Rica are classified on the basis of lithologic origin. A division of the country into lithologic zones is presented and the origins and distributions of the clays, in relation to volcanism and weathering, are discussed under each zone. Chemical and spectrographic analyses are presented to show compositions of clays and bauxitic laterites of different origins.—V.M.J.

3150 **Catanzaro, Edward John.** A study of discordant zircons from the Little Belt (Montana), Beartooth (Montana), and Santa Catalina (Arizona) Mountains [abs.]: Dissert. Abs., v. 26, no. 3, p. 1589–1590, 1965.

2867 **Chang, F. M.; Simons, D. B.; Richardson, E. V.** Total bed-material discharge in alluvial channels: U.S. Geol. Survey Water-Supply Paper 1498-I, p. I1–I23, illus., 1965.

This is a study of total bed-material discharge (wash load excluded) in alluvial channels, based partly on existing theories. The contact-bed-material discharge was obtained by utilizing the energy-work relation of the fluid and bed material. An equation for velocity distribution was obtained by integrating the Reynolds equation through use of the Prandtl's hypothesis of mixing length. Through application of the basic equation for the distribution of suspended bed material by M. P. O'Brien, the suspended-bed-material discharge was investigated in terms of contact bed-material discharge. Then, the total bed-material discharge was obtained simply by adding the contact-bed-material discharge and the suspended-bed-material discharge. . . .—Authors' abstract

3287 **Chayes, Felix.** Titania and alumina content of oceanic and circumoceanic basalt: Mineralog. Mag., v. 34, no. 268, p. 126–131, illus., tables, 1965.

Most circumoceanic basalts contain less and most oceanic basalts considerably more than 1.75 percent of TiO_2. The difference of TiO_2 averages is large enough to require rejection of the hypothesis that circumoceanic basalt results from the assimilation of sial by oceanic basalt.—Author's abstract

2988 **Chen, Ju-chin.** Petrofabric studies of some fine-grained rocks by means of X-ray diffraction [abs.]: Houston Geol. Soc. Bull., v. 8, no. 5, p. 16, 1966.

Christian, John E. *See* Ziemer, Paul L. 3086

2836 **Christiansen, Robert L.; Lipman, Peter W.** Geologic map of the Topopah Spring NW quadrangle, Nye County, Nevada: U.S. Geol. Survey Geol. Quad. Map GQ-444, scale 1:24.000, sections, 1965.

2837 **Chute, Newton E.** Geologic map of the Scituate quadrangle, Plymouth County, Massachusetts: U.S. Geol. Survey Geol. Quad. Map GQ-467, scale 1:24,000, 1965.

2838 **Chute, Newton E.** Geologic map of the Duxbury quadrangle, Plymouth County, Massachusetts: U.S. Geol. Survey Geol. Quad. Map GQ-466, scale 1:24,000, 1965.

Claringbull, G. F. *See* Bragg, Lawrence. 3062

Clark, David L. *See* Rigby, J. Keith. 2809

3085 **Cleveland, John H.** Variation of iron sulfide content in sphalerites of Mississippi Valley deposits: Indiana Acad. Sci. Proc. 1964, v. 74, p. 271-277, illus., table, 1965.

The purpose of this investigation was to determine the FeS content of the sphalerites and compare them with liquid inclusion temperature values. The FeS content of 114 samples taken from 40 specimens gives no indication of temperatures higher than those given by liquid inclusions. The evidence gathered from this study suggests that the use of FeS content variation of sphalerite as a precise geological thermometer, especially under low temperature conditions, is subject to question because of factors other than temperature controlling the variation.—E.S.L.

3196 **Clifton, H. Edward.** Tectonic polish of pebbles: Jour. Sed. Petrology, v. 35, no. 4, p. 867-873, illus., 1965.

Polished pebbles marked with parallel microstriations occur in Miocene rocks in California and various stratigraphic units elsewhere. The striations tend to be oriented normal to the regional structural trend. Tectonic origin of polish and striations by internal movement during deformation is suggested.—E.J.C.

2873 **Cloos, Ernst.** Appalachenprofil 1964 [with English, French, and Russian abs.]: Geol. Rundschau, v. 54, no. 2, p. 812-834, illus., table, 1965.

Folding in the Appalachian area took place at least twice. In the first period the Blue Ridge Zone, which is the western margin of the basement complex, was uplifted and crowded westward. The thin layer of Cambrian-Ordovician sediments covering it was folded simultaneously. This highland furnished material for Upper Ordovician to Carboniferous sediments to the east. The second period of folding was the Appalachian orogeny in which the upper part of the Paleozoic column was folded near the surface, with little influence by the basement. Three structure profiles are included.—E.S.L.

Cluff, Lloyd S. *See* Radbruch, Dorothy H. 2980

3259 **Coast Geological Society; SEPM, Pacific Sec.** Western Santa Ynez Mountains, Santa Barbara County, California—Field trip, October 1965, guidebook: [n.p.] Coast Geol. Soc., 47 p., illus., tables, geol. map, 1965.

The field trip offers an opportunity to see on the surface the stratigraphic units of the Eocene, Oligocene, and Miocene which are of interest not only onshore but in the adjacent offshore area of the Santa Barbara channel. Four papers on the stratigraphy, paleogeography, and structure are cited separately.—E.S.L.

2866 **Cohen, Philip.** (and others). Water resources of the Humboldt River valley near Winnemucca, Nevada: U.S. Geol. Survey Water-Supply Paper 1795, 143 p., illus., tables, geol. map, 1965.

Qualitative and quantitative relations among components of the hydrologic system in the Winnemucca Reach of the Humboldt River valley are described. Unconsolidated Tertiary and Quaternary deposits underlie valley lowlands to a depth of about 5,000 feet, are in hydraulic continuity with the Humboldt River, and store and transmit most of the economically recoverable water. A highly permeable sand

and gravel deposit, 90–100 feet thick underlies the flood plain and bordering terraces and contains 500,000 acre-feet of water. The river is the source of 90–95 percent of surface-water inflow. Aspects of climatology and geology and their relation to the hydrologic system are described, preliminary hydrologic-budget analyses are given for three selected time intervals, and results of hydrologic studies are used to evaluate water-management problems.—V.S.N.

3042 **Coker, Alfred E.** Geologic map of the Jones Knob quadrangle, Tennessee, and coal map of the Nemo, Morgan Springs, and an unnamed seam, Jones Knob quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 116-NW, 2 sheets, scale 1:24,000, separate text, 1965.

The coal-bearing rocks (Pennsylvanian lower Pottsville Series) underlie all of the Jones Knob quadrangle. Coal seams that have been mined or prospected are interbedded with shales, siltstones, and sandstones of the Crab Orchard Mountains Group. Estimated reserves of recoverable coal are 515,000 tons, all in the Nemo seam. Dimension sandstone is being quarried in the Rockcastle Sandstone where quarry dimensions are approximately 300 feet by 1,500 feet and the average face height is about 20 feet. Potential resources of economic value are sand for construction purposes and shale for lightweight aggregate and ceramic uses. M.C.M.

3032 **Cole, Frank W.** Producing characteristics of the Ellenburger formation of North Texas, *in* Symposium on the Arbuckle: Tulsa Geol. Soc. Digest, v. 32, p. 136–141, illus., tables, 1964.

The Ellenburger Formation, which is the deepest oil producing horizon in northern Texas, is usually a secondary objective in oil exploration because of the small areal extent of previously-found production. The oil is high gravity, and primary recovery averages 25 percent. Several fields are described, and production for the Wichita Falls district is tabulated.—E.S.L.

2887 **Collinson, Charles.** Conodonts, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 94–102, 1965.

Conodonts are rarely seen in the field, and in modern practice, rocks believed to contain them are generally collected and returned to the laboratory. Thus the collector must have some advance knowledge of where conodonts are likely to be found. The abundance of the fossils according to the type of rock is discussed, and a philosophy of conodont collecting is given. The plan for collecting is divided into reconnaissance, selective re-collecting of reconnaissance samples, and bulk re-collecting. Collection of subsurface samples and the dangers of contamination are included.—E.S.L.

Colquhoun, Donald J. *See* Atlantic Coastal Plain Geol. Assoc. 2922

Conover, J. Towne. *See* Dillon, William P. 3176

Cooley, Maurice E. *See* Kottlowski, Frank E. 3312

2803 **Cooper, G. Arthur; Whittington, H. B.** Use of acids in preparation of fossils, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 294–300, 1965.

If there is a difference in chemical composition between fossil and matrix, acid may be used to aid in separation. Preparation of fossils replaced by quartz, opaline silica, or anhydrite; chitinous fossils; and fossils composed of calcium phosphate are discussed. Production of artificial molds and artificial replacement conclude the paper.—E.S.L.

3220 **Corbett, Robert Guy.** The geology and mineralogy of Section 22 mine, Ambrosia Lake uranium district, New Mexico [abs.]: Dissert. Abs., v. 26, no. 6, p. 3242, 1965.

3257 **Corey, William H.** The paleogeography of the Lower Tertiary formations of Santa Barbara County, California, *in* Western Santa Ynez Mountains, Santa Barbara County, California—Coast Geol. Soc. and SEPM Pacific Sec., Field Trip 1965, Guidebook: [n.p.] Coast Geol. Soc., p. 31–37, illus., 1965.

Compilation of all surface and subsurface data on the six formations in the lower Tertiary has revealed that the formations can be divided into the Gaviota–Coldwater–Sacate zone, the Alegria–Sespe zone, and the Vaqueros zone. The first zone is a series of facies of similar sandstones deposited by offshore currents; the second is divided between the marine Alegria and the interbedded nonmarine Sespe (a map shows a generalized pattern of land area and maximum sea encroachment during early Miocene time); and the third has sediments of types deposited by coastal currents and wave action along beaches and shelf edges, and around shoals.—E.S.L.

3207 **Cox, Allan; Doell, Richard R.; Dalrymple, G. Brent.** Quaternary paleomagnetic stratigraphy, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 817–830, illus., table, 1965.

Paleomagnetic polarity epochs are defined as time intervals when the Earth's magnetic field was entirely or predominantly of a uniform polarity. A geochronometric–paleomagnetic time scale is presented. Paleomagnetic stratigraphic correlations between localities as far apart as Alaska, New Mexico, and Hawaii are given in a chart. The bearing of paleomagnetic results on intercontinental correlation of the Pliocene–Pleistocene boundary is discussed.—E.S.L.

2921 **Cox, Dennis P.; Cox, Helen R.** Introductory geology—A programmed text (preliminary edition): San Francisco, Calif., W. H. Freeman and Co., 268 p., illus., 1965.

This volume embodies a program of self-instruction in basic geology. It is meant to complement textbooks, lectures, and laboratory work. Questions and answers arranged on alternate pages are a guide to basic terms and principles.—E.S.L.

Cox, Helen R. *See* Cox, Dennis P. 2921

3117 **Craig, James Roland.** A systematic study of phase equilibria in the Ag–Bi–S system and exploration of the geologically significant portion of the Ag–Bi–Pb–S system [abs.]: Dissert. Abs., v. 26, no. 5, p. 2787, 1965.

3255 **Crandell, Dwight R.** The glacial history of western Washington and Oregon, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 341–353, illus., tables, 1965.

Pleistocene glaciers consisted of the Cordilleran ice sheet, which invaded northern Washington on both sides of the Cascade Range, and alpine glaciers in Washington and Oregon. Two earlier major Cordilleran glaciations are recorded in the Puget Sound area, each consisting of two or more advances. In addition three glacial episodes occurred during late Pleistocene time. During the earlier two of these, valley and piedmont glaciers were fed by vast ice fields and ice caps in the Cascade Range of both States, and the Olympic Mountains of Washington. During the Frazer Glaciation the Cordilleran ice sheet reached its maximum stand south of Seattle, between 15,000 and 13,500 years ago. Two glacial episodes in post Altithermal time are recorded at Mount Rainier.—*from* Author's abstract

3099 **Crane, David Clinton.** Geology of the Jocotán and Timushán quadrangles, southeastern Guatemala [abs.]: Dissert. Abs., v. 26, no. 5, p. 2686–2687, 1965.

3090 **Crocket, James H.; Skippen, George B.** Radioactivation determination of palladium in basaltic and ultrabasic rocks: Geochim. et Cosmochim. Acta, v. 30, no. 1, p. 129–141, illus., tables, 1966.

Results of neutron activation analyses of the Pd content of 23 basaltic and 4 ultrabasic rocks and a sample of Sudbury quartz diorite are presented. Oceanic basalts show less variation in Pd than continental. Although crystal fractionation during magma crystallization is probably an important factor in producing Pd

variations in basalts, the regional trends found in the plateau-building rocks suggest that the Pd content of the source material is also an important parameter. The Pd data are discussed briefly in terms of recent hypotheses of basalt petrogenesis.—D.B.V.

3283 **Curray, Joseph R.** Late Quaternary history, continental shelves of the United States, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 723–735, illus., 1965.

In late Quaternary, the continental shelves were alternately exposed and inundated. The most recent maximum exposure occurred about 18,000 years ago, and was followed by rapid marine transgression. The rate of rise of sea level decreased markedly about 7,000 years ago, and has remained at approximately its present position since. The shelf off the eastern United States is covered almost entirely by relict nearshore sands of the transgression; recent muds are trapped in estuaries. Much of the Florida and northeastern Gulf of Mexico shelf is covered with calcareous facies. The northwestern Gulf and Pacific Coast shelves are covered with patches of both mud and relict nearshore sands. It is suggested that eustatic sea-level fluctuations may be the best basis for correlation of Quaternary events.—E.S.L.

Cushing, E. J. *See* Wright, H. E. 2756

3311 **Cushing, Edward J.** Problems in the Quaternary phytogeography of the Great Lakes region, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 403–416, illus., 1965.

This paper examines some of the problems raised by the present distribution of plant taxa and vegetation types in the glaciated midcontinent, and explores the relevance of these problems to interpretation of the available Quaternary fossil record in the region.—E.S.L.

3221 **Cvancara, Alan Milton.** Bivalves and biostratigraphy of the Cannonball Formation (Paleocene) in North Dakota [abs.]: Dissert. Abs., v. 26, no. 6, p. 3243–3244, 1965.

Dalrymple, G. Brent. *See* Cox, Allan. 3207

3189 **Damestoy, Guy.** Description d'une nouvelle espèce de *Coralliochama* (Lamellibranches) provenant du Cénomanian du Mexique: Soc. Géol. France Compte Rendu 1965, no. 6, p. 209–211, illus., 1965.

Coralliochama flouriei nov. sp. is described. The study of this complete individual found in the Cretaceous of Punta Banda, Baja California, gives new information on the genus.—E.S.L.

2933 **Danner, Wilbert R.** Limestone of the western Cordilleran eugeosyncline of southwestern British Columbia, western Washington and northern Oregon, *in* Dr. D. N. Wadia Commemorative Volume: Calcutta, India, Mining, Geol. and Metall. Inst. India, p. 113–125, illus., 1965.

Limestone is more abundant in Paleozoic and Triassic eugeosynclinal sequences of the western Cordillera of North America than is generally realized. Beds range in thickness from a few inches to 3,500 feet and may extend over an area of 100 or more square miles. Most bodies are lenticular in shape and are interbedded with sequences of volcanic rocks, ribbon cherts, argillites, lithic sandstones and siltstones, conglomerates and graywacke. The limestones are mostly organic in origin and contain almost the only fossils preserved in the earlier eugeosynclinal sequence. In Jurassic, Cretaceous and Cenozoic time the eugeosyncline was the site of much greater clastic deposition. Consequently the amount of limestone is much less and of more specialized type of deposition.—Author's abstract

3222 **Davis, James Frazier.** A petrologic examination of iron-formation and associated graywackes and pyroclastic breccias within the Negaunee Formation of the Palmer area, Marquette district, Michigan [abs.]: Dissert. Abs., v. 26, no. 6, p. 3244, 1965.

2763 **Davis, Margaret B.** A method for determination of absolute pollen frequency, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 674–686, illus., tables, 1965.

The method described here is similar in principle to those of Erdtmann and Muller, but combines the advantages of both. The accuracy is similar to that obtained with a haemocytometer, but the pollen counts are made under high magnification on ordinary microscope slides suitable for phase microscopy, photomicrography, and storage for future reference. Methods and results are discussed.—E.S.L.

3184 **Davis, Margaret B.** Sediment traps for measuring pollen deposition [abs.], *in* Conf. on Great Lakes Research, 8th, Ann Arbor, 1965, Proc.: Michigan Univ. Great Lakes Research Div. Pub. 13, p. 248, 1965.

3332 **Davis, Margaret B.** Phytogeography and palynology of northeastern United States, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 377–401, illus., tables, 1965.

Past distributions of plants interpreted from the fossil record are usually explained as responses to climatic changes. The increase in conifers in the most recent pollen zone, however, can more easily be correlated with forest clearance by man. This reinterpretation would change the estimated age of the deposits, and consequent correlation with post-hypsithermal deposits elsewhere. Following the retreat of Wisconsin ice, a subarctic vegetation developed and persisted for 2,000 years; forest vegetation began about 11,500 years ago, with abundant boreal species; and at about 8,000 years B.P. temperate deciduous trees became more abundant. The frequency of hemlock pollen was reduced about 5,000 years ago; this was a widespread event. Radiocarbon dates from pollen sequences are tabulated in chronological order. Dates rangè from 38,000 to 400 yr B.P.—E.S.L.

3127 **Davis, Phillip Nixon.** Palynology and stratigraphy of the Lower Cretaceous rocks of northern Wyoming [abs.]: Dissert. Abs., v. 26, no. 4, p. 2132, 1965.

3181 **Davis, Richard A., Jr.; McGeary, David F. R.** Stability in nearshore bottom topography and sediment distribution, southeastern Lake Michigan, *in* Conf. on Great Lakes Research, 8th, Ann Arbor, 1965, Proc.: Michigan Univ. Great Lakes Research Div. Pub. 13, p. 222–231, illus., 1965.

Detailed underwater study of nearshore areas in southeastern Lake Michigan indicates that bottom topography and sediment distribution are relatively stable. Seven sets of traverses were run with a period of two months between them, and two sets were run before and after storms. No apparent distinction exists between data collected after two months and that collected after storms. Offshore bars are constant in their relationship to the shore but show some variation in profile shape. Indices of similarity for depth of water, mean grain size and sorting show good correlation between traverses, with mean grain size having lowest values.—Authors' abstract

3195 **Davis, Richard A., Jr.** Underwater study of ripples, southeastern Lake Michigan: Jour. Sed. Petrology, v. 35, no. 4, p. 857–866, illus., 1965.

Underwater ripple marks at 400 locations along 21 traverses in Lake Michigan were examined with respect to shape, size, composition and orientation. Conclusions are that shape is primarily a function of relative physical energy and composition; size is controlled by topographic position and grain size; orientation is determined primarily by wind direction and, to some extent, by shoreline direction. Ripple marks are not considered reliable for establishing ancient shoreline directions.—E.D.M.

3128 **Davis, Richard Albert, Jr.** Sedimentation in the nearshore environment, southeastern Lake Michigan [abs.]: Dissert. Abs., v. 26, no. 4, p. 2132–2133, 1965.

DeBrosse, Theodore A. *See* Norling, Donald L. 2903

3323 **Deer, W. A.; Abbott, D.** Clinopyroxenes of the gabbro cumulates of the Kap Edvard Holm complex, east Greenland: Mineralog. Mag., v. 34, no. 268, p. 177–193, illus., tables, 1965.

The division of the layered rocks of the Kap Edvard Holm complex into an upper and lower series is based on abrupt and major changes in compositions of pyroxenes, olivine, and plagioclase. The break correlates with injection of an undifferentiated magma after much of the lower layered series was consolidated, which formed the rocks of the upper series. Analyses are presented for 12 pyroxenes (5 from the lower and 7 from the upper); relations between optical properties and chemical composition, and between cell parameters and composition are discussed. Crystallization trends are compared with those of the Skaergaard calcium-rich pyroxenes. Analytical data are tabulated.—V.S.N.

2757 **Deevey, Edward S., Jr.** Sampling lake sediments by use of the Livingstone sampler, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 521–529, illus., 1965.

The sampler is designed for manual operation from a small raft in water shallow enough to permit the use of extension rods. It is not a peat borer, and can be used only for saturated bog sediments. It has been used in water up to 30 m deep, and cores have been taken through sediments as thick as 18 m. The core is taken in sections one meter long. The sampler is described and illustrated, and materials needed for its construction are listed. Suggestions are made for field operation, care of samples, and reckoning depth.—E.S.L.

3319 **Deevey, Edward S., Jr.** Pleistocene nonmarine environments, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 643–652, 1965.

In this paper commenting on the biological chapters, the definition of the term biogeography, the methodology, and justification for its use are discussed. Deductions as to landbridges, pluvial climates, etc. require inversion of the biogeographic argument. Some applications of this to the Pleistocene are given. Postglacial and late glacial stratigraphy in the light of pollen sequences is discussed. In the discussion of the older Pleistocene, the author speculates on the significance to the accepted division of the Pleistocene of the fact that fossils of Yarmouth age are almost unknown.—E.S.L.

Delicate, D. T. *See* Young, W. E. 3058

3272 **DeLong, Richard M.** Geology of the Malvern quadrangle, Ohio: Ohio Div. Geol. Survey Rept. Inv. 57, 1 sheet, scale 1:24,000, section, text, 1965.

Coal of economic interest in the Malvern quadrangle is found in the Lower and Middle Kittanning, Lower Freeport, and Mahoning Coals. The Lower and Middle Kittanning Clays are the basis for the ceramic industry along the Sandy Creek valley, and the Lower is used also for manufacture of lightweight aggregate at Pekin. Limestones are thin and irregular, the Upper Freeport being the thickest but not sufficient in reserves to be mined on a large scale. Shale, sandstone, sand and gravel are also found in the quadrangle; there have been small shows of gas or oil, and salt occurs in several beds aggregating 200–300 feet in thickness.—M.C.M.

3055 **deNevers, Noel.** Tar sands and oil shales: Sci. American, v. 214, no. 2, p. 21–29, illus., 1966.

Tar sands and oil shales constitute the world's largest potential liquid-hydrocarbon reservoirs, but they cannot be exploited by ordinary oil-producing methods. The largest of each of these types of deposits, the Athabasca tar sands of northern Alberta and the Green River oil shales of Colorado, Utah, and Wyoming, respectively, are described briefly and their differences noted. The various factors—technical, economic, and political—that control the pace of their exploitation are discussed.—D.W.R.

2766 **Dettmann, Mary E.** Techniques used in the study of megaspores, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 699–706, illus., 1965.

Preparation of samples from coal and clastic sediments is described, including sieving, storing, and sorting residues. Both dry and translucent mounts should be made of each species. Steps are outlined for sectioning, following a modification of the embedding and sectioning techniques of Wigglesworth. Methods for photographing are given.—E.S.L.

3003 **Deurbrouck, A. W.; Palowitch, E. R.** Survey of sulfur reduction in Appalachian region coals by stage crushing: U.S. Bur. Mines Inf. Circ. 8282, 37 p., illus., table, 1966.

Sulfur content ranges from 0.6 to 6.5 percent in several hundred samples of bituminous coal collected from important productive beds of the Appalachian region in states other than Alabama. Sulfur is least in some beds in West Virginia and greatest in parts of some beds in Noble County, Ohio, Butler County, Pa., and Marion and Putnam Counties, Tenn.—A.P.B.

3297 **Dibblee, T. W., Jr.** Geologic structure of the Santa Ynez Mountains from Point Conception to San Marcos Pass, *in* Western Santa Ynez Mountains, Santa Barbara County, California—Coast Geol. Soc. and SEPM Pacific Sec., Field Trip 1965, Guidebook: [n.p.] Coast Geol. Soc., p. 42–47, illus., 1965.

The stratigraphic assemblages pertaining to the tectonic evolution of the mountains are discussed briefly. Beds in the area north of the Santa Ynex fault system thin rapidly northward, while the assemblage south of the fault is about 22,000 feet thick. This thick sedimentary sequence was tilted southward, pushing upward and eastward against the north flank where the beds became complexly folded, possibly by left lateral drag. The Santa Ynez fault system is described and two cross sections are given. Structure of the foothill and coastal area is included.—E.S.L.

2856 **Dickinson, Robert G.** Geologic map of the Cerro Summit quadrangle, Montrose County, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ–486, scale 1:24,000, sections, 1965.

The map sheet includes a table showing faunal zones represented in the U.S. Geological Survey Mesozoic fossil localities in the Cerro Summit quadrangle. Faunal zones are not determined for all localities on the map.—M.C.M.

3176 **Dillon, William P.; Conover, J. Towne.** Formation of ice-cemented sand blocks on a beach and lithologic implications: Jour. Sed. Petrology, v. 35, no. 4, p. 964–967, illus., 1965.

Contorted blocks of ice-cemented sand, observed on an ocean beach [Rhode Island], were apparently formed by storm conditions accompanied by low temperatures and later erosion and melting. Such blocks, if included into an aggrading beach, could produce unusual minor structures.—Authors' abstract

2869 **Dix, C. H.** Reflection seismic crustal studies: Geophysics, v. 30, no. 6, p. 1068–1084, illus., table, 1965.

It is shown that under favorable conditions many quite good reflections can be obtained from within the crust. They are strong enough and numerous enough to suggest that they may originate from several large sills. Details of the evidence and arguments for this necessarily indirect conclusion are discussed. The reflection method is considered to be the only method of obtaining detailed information on the structure and composition of the deeper crust; refraction methods cannot yield adequate detail. The angle of reflection should be kept as small as possible to stay near the reflection maximum at normal incidence, and the receivers should be offset far enough that the decay of surface wave noise from the source permits reflections to be seen. Appendixes treat strike and dip computation, normal time corrections used for correlations, and waves passing through focuses.—D.B.V.

2834 **Dixon, H. Roberta.** Bedrock geologic map of the Plainfield quadrangle, Windham and New London Counties, Connecticut: U.S. Geol. Survey Geol. Quad. Map GQ-481, scale 1:24,000, sections, 1965.

2843 **Dobrin, Milton B.; Ingalls, Arthur L.; Long, James A.** Velocity and frequency filtering of seismic data using laser light: Geophysics, v. 30, no. 6, p. 1144–1178, illus., 1965.

When coherent light from a laser beam is passed through a transparent reduction of a variable-density or variable-area record section, the seismic signal acts as an optical grating to produce a diffraction pattern which is the two-dimensional Fourier transform of the section itself. With suitable lenses the diffraction pattern can be converted back into an image of the original section. By obstructing portions of the pattern corresponding to particular frequencies or dips on the section, one can remove such frequencies or dips from the reconstructed image. The equipment developed is described. Applications include removal of multiple reflections, elimination of noise which consists of traveling events having different apparent velocities from the reflections, removal of diffractions or their enhancement to delineate faults, and attenuation or elimination of ringing in marine shooting. D.B.V.

2808 **Dodd, James R.** Preparing fossils and shells for chemical analysis, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 384–388, illus., 1965.

The development of improved analytical techniques has made chemical analyses of fossils and shells more readily available in recent years. The usefulness of this data is an incentive for further study. Procedures for general sample preparation are given for different types of study.—E.S.L.

Doell, Richard R. *See* Cox, Allan, 3207

2996 **Dolan, Robert; McCloy, James.** (compilers). Selected bibliography on beach features and related nearshore processes: Louisiana State Univ. Studies, Coastal Studies Ser., no. 11, 59 p., 1965.

Fields covered in the bibliography are: beach and nearshore features and processes, coastal engineering, quantitative analysis of data, and bibliographies and other source materials. Listing is limited to materials available in the libraries of the Coastal Studies Institute and Louisiana State University, and references considered most relevant by the compilers. It contains about 75 percent of the most pertinent literature on the subjects under consideration. An author index is included. M.C.M.

2986 **Dollison, R. S.** Big Hill Field, Jefferson County, Texas [abs.]: Houston Geol. Soc. Bull., v. 8, no. 5, p. 14, 1966.

2870 **Dondoli B., César.** Información general geológico-petrográfica y mineralógica sobre Costa Rica: Costa Rica Dept. Geología, Minas y Petróleo Informes, v. 4, no. 13, 21 p., 1965.

Areal geology of Costa Rica is sketched, with emphasis on the diorites, granites, syenites, basalts, and other igneous rocks that underlie the Cordillera de Talamanca and other mountain ranges. Intrusive activity was intensified during the upper Miocene and Pliocene, and volcanism during the Pliocene and Pleistocene. Gold is the most important mineral resource, occurring in quartz veins through the porphyritic basalt of the upper Miocene Aguacate Formation in the Abangares and Aguacate mountains, and also as placers in the Golfo Dulce and Osa Peninsula areas. Manganese, lead, zinc, bauxitic laterite, and sulfur are also of importance. Metals and associated industrial minerals are discussed under eight areas considered deserving of continued or future exploration.—V.M.J.

3024 **Dondoli B., César.** Volcanismo reciente de Costa Rica: Costa Rica Dept. Geología, Minas y Petróleo Informes, v. 4, no. 15[B], 6 p., 1965.

The Cordillera del Guanacaste and the Cordillera Volcánica Central, which border the Nicaraguan trench, were formed by intense Pliocene–Pleistocene volcanism and show evidence of Recent activity; three of the four volcanoes of the Cordillera Volcánica Central have been active in historic times. Activity of Poás volcano is fumarolic and has never entirely ceased; in 1953 sulfur-bearing vapors, ash, and lava blocks were emitted with explosive force. Irazú erupted in 1723 and 1842; present activity began in 1963 and reached maximum explosive intensity in May 1964. Turrialba erupted explosively in 1864 only. Lava and ash of Irazú and Turrialba are of the andesitic type prevalent in Costa Rica; those of Poás and Barba (not active in historic time) are more basic, commonly with accessory olivine. V.M.J.

2776 **Dorf, Erling.** Plants—Mesozoic and Cenozoic forms, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 127–134, illus., 1965.

Most of the megascopic nonmarine remains preserved in rocks of Mesozoic or Cenozoic age are fossil leaves. Shales, especially those associated with coals, are good sources of plant fossils. Also the finer grained pyroclastics are excellent for preservation of a great variety of remains. Techniques are divided into locating plant-bearing beds, quarrying for good specimens, what to collect, field sorting, wrapping, and laboratory preparation.—E.S.L.

2814 **Douglass, Raymond C.** Photomicrography of thin sections, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 446–453, 1965.

The photography of thin sections requires an adequate source of light, a satisfactory method of focusing, lenses capable of providing the desired magnification, and a holder for the sensitized material. The discussion is divided into sections on lighting, optics, shutters and light controls, sensitized materials, the stand, and operation, including a checklist for making exposures.—E.S.L.

2818 **Douglass, Raymond C.** Larger foraminifers, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 20–25, 1965.

Larger Foraminifera range in size from less than 1 mm to more than 10 cm. They can be considered in two categories, Paleozoic which consist dominantly of fusulinids, and post-Paleozoic which are dominantly orbitoids and nummulitids. Larger foraminifers are studied principally in thin section; sectioning techniques are described.—E.S.L.

2796 **Dow, Verne E.** Magnetic separation of conodonts, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 263–267, illus., 1965.

The Franz isodynamic magnetic separator, which has been used for separating conodonts, is described. The residue should be reduced as far as possible and, after washing and drying, examined with a microscope to determine the dominant mineralogy, which determines the various settings for the first run. Settings for various types of residues are given. The range of susceptibility of quartz, dolomite, and conodonts is discussed.—E.S.L.

Dreeszen, V. H. *See* Reed, E. C. 3251

Dreimanis, Aleksis. *See* Goldthwait, Richard P. 3247

3083 **Durden, Christopher J.** Oligocene lake deposits in central Colorado and a new fossil insect locality: Jour. Paleontology, v. 40, no. 1, p. 215–219, illus., 1966.

A new fossil insect locality was found in the Oligocene Antero Formation, exposed in Park County, Colo.; plant and animal remains also were found. The plant and vertebrate fossils indicate that the Antero Formation and the Florissant lake beds are contemporaneous.—S.H.M.

3147 **Durek, Joseph John.** Some characteristics of weathered outcrops of disseminated copper deposits [abs.]: Dissert. Abs., v. 26, no. 3, p. 1590, 1965.

2825 **Durham, J. Wyatt.** Echinoderms, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 57–61, illus., 1965.

The Echinodermata are characterized by a skeleton or test of mesodermal origin in which each plate is a single calcite crystal and has a distinctive reticulate microstructure. They are found in marine rocks of all ages from Early Cambrian to Recent, and range greatly in size and morphology. Any large plate or fragment of a fossil that shows well-developed calcite cleavage should be suspected of being an echinoderm. Once it has been recognized, echinoderm preparation proceeds according to the character of the matrix. Techniques are briefly described.—E.S.L.

2822 **Dutro, J. T., Jr.** Brachiopods, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 44–48, 1965.

Collecting techniques according to the use to be made of the material collected, and modes of preservation of brachiopods are described.—E.S.L.

2828 **Edgar, A. D.** Lattice parameters of melilite solid solutions and a reconnaissance of phase relations in the system $Ca_2Al_2SiO_7$ (gehlinite)–$Ca_2MgSi_2O_7$ (akermanite)–$NaCaAlSi_2O_7$ (soda melilite) at 1,000 kg/cm^2 water vapor pressure: Canadian Jour. Earth Sci., v. 2, no. 6, p. 596–621, illus., 1965.

In this system, although the range of complete solid solution is very limited, melilites form more than 90 percent of the products in most compositions and their lattice parameters can be correlated approximately with their bulk compositions. A rapid X-ray method has been developed to determine the approximate compositions of melilites in this system. Comparison is made between the synthetic samples and natural melilite. A reconnaissance of subsolidus phase relations indicates that they are very complex and that only over a very small compositional range can these systems be considered binary or ternary.—*from* Author's abstract

Eggert, D. A. *See* Hibbert, F. A. 2960

3223 **Ehrreich, Albert LeRoy.** Metamorphism, migmatization, and intrusion in the foothills of the Sierra Nevada, Madera, Mariposa, and Merced Counties [abs.]: Dissert. Abs., v. 26, no. 6, p. 3245, 1965.

Elston, D. P. *See* Poole, F. G. 2839

3020 **Engels, Bruno.** Geologische problematik und strukturanalyse Nikaraguas (Ein Beitrag zur Geologie Mittelamerikas) [with English, French, and Russian abs.]: Geol. Rundschau, v. 54, no. 2, p. 758–795, illus., 1965.

In the basement rocks of northern Nicaragua tuffites are important petrologically and are guide horizons for geologic mapping. On a regional scale the basement rocks appear very uniform and do not need to be divided into formations. Structurally the area is very complex. Probably the Totogalpa Formation, lying disconformably on the basement, belongs to the Tertiary sequence of tuffites, lavas, etc. To the south the Lower Cretaceous rests on the basement. In southern Nicaragua the Cretaceous to Miocene marine beds are only slightly deformed. To the north these are followed by a thick series of Tertiary–Quaternary volcanites. Lineaments are northwest-southeast and north-south. A geologic structure map accompanies the paper.—E.S.L.

3129 **Enos, Paul Portenier.** Anatomy of a flysch—Middle Ordovician Cloridorme Formation, northern Gaspé Peninsula [abs.]: Dissert. Abs., v. 26, no. 4, p. 2133, 1965.

2952 **Eugster, H. P.; Munoz, James.** Ammonium micas—Possible sources of atmospheric ammonia and nitrogen: Science, v. 151, no. 3711, p. 683–686, illus., tables, 1966.

Ammonium muscovite, $NH_4Al_2AlSi_3O_{10}(OH)_2$, and ammonium phlogopite, $NH_4Mg_3AlSi_3O_{10}(OH)_2$, have been synthesized hydrothermally at gas pressures between 550° and 730°C. Both micas are stable only in environments of high ammonia fugacity. Ammonia or nitrogen, or both, are released by thermal decomposition, cation exchange, or oxidation. The ammonia nitrogen ratio in the gas depends primarily on the hydrogen fugacity and the temperature of the environment. Calculations show that, even in predifferentiated Earth, nitrogen may have predominated. The total amount of nitrogen present on the surface of Earth could be accounted for by the decomposition of a layer of ammonium muscovite 170 meters thick.—Authors' abstract

Everett, J. E. *See* Bullard, Edward. 3067

2765 **Evitt, William R.** A method for making serial sections of pollen and other organic microfossils, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 696–699, 1965.

Detailed instructions are given for getting the fossil specimens into a tiny ball of wax which is embedded in a small block of wax mounted on the microtome.—E.S.L.

2891 **Faegri, K.; Iversen, J.** Field techniques, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 482–494, illus., table, 1965.

The aim of field work is to collect uncontaminated samples of the deposit, to define as exactly as possible the conditions under which the samples were taken, to determine the types of sediment, and to explain the stratigraphy. The first problem is the choice of a sampling site, and rules are set up for making the choice. Different types of samplers are described and illustrated. Methods of taking and preserving samples compose the rest of the paper.—E.S.L.

3039 **Fahrig, W. F.** Geology, Lac Herodier, Quebec: Canada Geol. Survey Map 1146A, scale 1:253,440, text in English and French, 1965.

The rock formations of the Lac Herodier area are described in some detail and related to the legend on the map. The rocks of the map-area have been regionally metamorphosed and deformed as a unit and in general the degree and grade of metamorphism increase northeastward. The major structure of the relatively unmetamorphosed Proterozoic rocks comprising the Labrador Trough is a broad complex syncline that plunges northwest and is probably faulted along its northeast flank. Sulfides occur within and near gabbro sills and the iron-formation is widespread. Some showings of zinc, copper, lead, and silver have been reported.—M.C.M.

Fairbridge, Rhodes W. *See* Richards, Horace G. 3001

2852 **Fajklewicz, Zbigniew J.** Fictitious anomalies of higher vertical derivatives of gravity: Geophysics, v. 30, no. 6, p. 1094–1107, illus., 1965.

Computation of first and second vertical derivatives of gravity gives rise to anomalies that suggest local features which do not really exist; on the average, two to four such fictitious anomalies appear for every true anomaly, and they are often strong enough to be misleading. An attempt is made here to show how they occur. Inherent limitations in the interpretation methods based on derivatives which cannot be overcome by improvements in the methods of computing derivatives, are evident.—D.B.V.

2831 **Feininger, Tomas.** Surficial geologic map of the Voluntown quadrangle, Connecticut-Rhode Island: U.S. Geol. Survey Geol. Quad. Map GQ-469, scale 1:24,000, separate text, 1965.

Surficial deposits of the Voluntown quadrangle, unconsolidated and lying on an irregular bedrock floor, are nearly all of Pleistocene age and include ground moraine, ice-contact stratified deposits, and lake deposits. Postglacial deposits are limited to scattered thin deposits in swamps. Porosity and permeability, ease of excavation, compaction, and ability to stand in cuts affect the economic usefulness of the deposits. Rottenstone is an excellent road metal; till is well suited for use as fill and in earth dams, but its low permeability makes it a poor aquifer; only a small part of the glaciofluvial deposits is suitable as fill or aggregate, but the sediment coarser than fine sand is very permeable and an excellent aquifer; and the glacial-lake deposits contain clay probably suitable for brick manufacture.—M.C.M.

3224 **Felber, Bernhard E.** Silurian reefs of southeastern Michigan [abs.]: Dissert. Abs., v. 26, no. 6, p. 3245, 1965.

Ferm, J. C. *See* Meland, Nils, 3177

2819 **Finks, Robert M.** Sponges, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 25–35, 1965.

Five features to be observed, recorded, and illustrated in any taxonomic work on sponges are listed. Under collecting, both occurrence and removal are discussed. Preparation and study techniques for both whole specimens and individual spicules are given. Illustrating methods, drawings and photographs, are described. Under measurement, measurable characters, variability, and techniques are discussed. Sections on morphologic description, curating, and paleoecologic observations are included.—E.S.L.

Fischer, Alfred G. *See* Honjo, Susumu, 2791

Fischer, Alfred G. *See* Honjo, Susumu, 2882

3276 **Fischer, William A.** Infrared radiations of volcanic structures [also French and Spanish texts]: Photo Interprétation 1965–5, pt. 1, p. 1–6, illus., 1965.

The paper consists of a set of photographs of the summit of Kilauea volcano with an interpretive text. One pair of photographs at the same scale, the first panchromatic, the other infrared, are set beside each other for comparison. One photograph of the Halemaumau crater, at a larger scale, enables the reader to study in detail the relation between local structure and emissivity according to the infrared picture.—E.S.L.

2778 **Fisher, Donald W.** Collecting in sedimentary rocks, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 150–155, 1965.

This paper is divided into where, what, and how to collect. Under where, natural and artificial exposures are mentioned. What to collect gives a description of types of sedimentary rocks and fossil possibilities of each. The section on techniques covers mostly tools and equipment.—E.S.L.

3034 **Fisher, Donald W.** Mohawk Valley strata and structure, Saratoga to Canajoharie, Trip A, *in* Field trips in the Schenectady area—New York State Geol. Assoc., 37th Ann. Mtg., Union Coll., 1965, Guidebook: New York, City College of City Univ. of New York, Dept. Geology, p. A1–A58, illus., geol. map, 1965.

The geologic history of the area is reviewed briefly, and Late Cambrian to Middle Ordovician stratigraphy and faunal zones discussed and shown on charts. Structural features described are all due to faulting.—E.S.L.

2858 **Fleischer, Michael.** Summary of new data on rock samples G-1 and W-1, 1962–1965: Geochim. et Cosmochim. Acta, v. 29, no. 12, p. 1263–1283, tables, 1965.

Analyses of samples G-1 and W-1 made since 1962 are collected and "best values" for many elements are suggested.—D.B.V.

3317 **Flint, Richard Foster.** Introduction—Historical perspectives, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 3–11, tables, 1965.

Advances in knowledge in this field in the United States proceeded almost step by step with advances in Europe. In tracing the history of thought about the American Quaternary, Flint starts with the origin and physical features of glacial drift. As knowledge grew, interest spread to mapping the drift border, the idea of repeated glaciations, and stratigraphic subdivision. Loess origin, ice sheets and isostasy, sea-level changes, paleontology, and dating of the Pleistocene are also discussed. A section on the literature and scientists contributing to this growth of knowledge concludes the paper.—E.S.L.

2824 **Flower, Rousseau H.** Cephalopods—As illustrated by early Paleozoic forms, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 53–57, 1965.

The greatest problem presented by cephalopods is their relatively large size. Another serious problem stems from the fragmentary condition of remains of many of the forms. Ordinarily the phragmocones contain the crucial structures. Collecting techniques are given based on type of preservation, with special considerations for special groups and types.—E.S.L.

2983 **Forrester, James D.; Moore, Richard T.** Memorial to Eldred Dewey Wilson (1898–1965): Geol. Soc. America Bull., v. 76, no. 12, p. P187–P191, portrait, 1965.

Forsyth, Jane L. *See* Goldthwait, Richard P. 3247

3225 **Fowler, Gerald Allan.** The stratigraphy, foraminifera, and paleoecology of the Montesano Formation, Grays Harbor County, Washington [abs.]: Dissert. Abs., v. 26, no. 6, p. 3245–3246, 1965.

2847 **Franklin, D. W.; McFarlane, J. F.** Case history of the Lea field, Lea County, New Mexico: Geophysics, v. 30, no. 6, p. 998–1007, illus., 1965.

A reconnaissance seismograph survey was conducted during 1958 in the relatively unexplored north flank of the Delaware Basin in south central Lea County, N. Mex., using conventional methods. Data quality was fair. Interpretation was complicated by facies changes related to Permian reefing; sufficient control data to evaluate their effects were lacking. The seismic map showed about 450 feet of overall closure with fault along east flank; subsequent drilling checked the seismic map closely. The Lea field, discovered in 1960, covers about 2,280 acres and produces from three zones.—D.B.V.

3089 **Franz, G. W.; Wyllie, P. J.** Melting relationships in the system CaO–MgO–SiO_2–H_2O at 1 kilobar pressure: Geochim. et Cosmochim. Acta, v. 30, no. 1, p. 9–22, illus., table, 1966.

Solid–liquid–vapor phase relationships in the system CaO–MgO–SiO_2–H_2O have been determined at 1 kb pressure using the quench technique in cold seal pressure vessels. The phase fields intersected by the composition joins $Ca(OH)_2$–Mg_2SiO_4 and $Ca(OH)_2$–$MgSiO_3$ have been delineated in the temperature range 700°–950°C. A schematic diagram for the phase relationships on the vapor saturated liquidus surface has been prepared. The results provide a basis for interpretation of the phase relationships in the more complex system CaO–MgO–SiO_2–CO_2–H_2O which have a bearing on the petrogenetic relationships between kimberlites and carbonatites.—D.B.V.

3142 **Franz, Gilbert Wayne.** Melting relationships in the system CaO–MgO–SiO_2–CO_2–H_2O—A study of synthetic kimberlites [abs.]: Dissert. Abs., v. 26, no. 4, p. 2246, 1965.

3100 **French, William Edwin.** The sedimentary environment and geological evolution of the Manitou Passage area of Lake Michigan [abs.]: Dissert. Abs., v. 26, no. 5, p. 2687, 1965.

Frey, David G. *See* Wright, H. E., Jr. 3285

3304 **Frey, David G.** Other invertebrates—An essay in biogeography, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 613–631, illus., table, 1965.

In most groups of animals the faunistics and present distributions are insufficiently known to aid in the reconstruction of past distributions and evolution. One major effect of the climatic cycles is the occurrence of disjunct populations of northern species of invertebrates and fishes in the Gulf of Mexico and Gulf of California. Migration of cold adapted organisms took place across the landbridge between Siberia and Alaska. Interpretation of the evolution of present distributions of inland invertebrates, based on a floating time scale, is given.—E.S.L.

3204 **Fritts, Harold C.** Dendrochronology, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 871–879, illus., tables, 1965.

Variation in ring widths can be used to date and evaluate past patterns of precipitation and/or temperature occurring during the life of the plant. Primary techniques are site selection, cross-dating, and chronology building, but new statistical and botanical approaches also are being used. Climate influences growth through control of food accumulation. Ring width produced is largely a function of stored food, hence related to climate variations. Dendrochronology provides the only method that can be used to evaluate yearly fluctuations in past climates.—E.S.L.

2775 **Frizzell, Don L.** Otoliths, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 125–127, 1965.

Fossil otoliths of teleost fishes are only incompletely collected in the usual search for megafossils and are rarely found in conventional microfossil samples. They are to be sought in restricted facies of marine formations of Triassic age and younger. Collections worthy of study result from special field and laboratory techniques. These are discussed in sections on lithologic restriction, field collecting, segregation in the laboratory, and preparation of specimens.—E.S.L.

3245 **Frye, John C.; Willman, H. B.; Black, Robert F.** Outline of glacial geology of Illinois and Wisconsin, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 43–61, illus., tables, 1965.

Deposits of each of the four glacial stages occur in Illinois and Wisconsin, as do soils formed during each of the three major interglacial stages. Type areas for the Wisconsin, Illinoian, and Sangamon Stages lie in the region. Because of its position in the area of overlap of tills deposited by glaciers from both eastern and western dispersal centers, Illinois is the only place where the physical relations of pre-Illinoian tills from these two centers can be examined. It is also a focal point of drainage diversions. The stratigraphic succession is briefly outlined and correlation methods described. Recent work on the mineralogy of Pleistocene deposits, the subdivision and classification of the Illinoian and Wisconsin Stages, and the evidence for glaciation of the Driftless Area are discussed also.—*from* Authors' abstract

3299 **Frye, John C.; Leonard, A. Byron.** Quaternary of the southern Great Plains, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 203–216, illus., table, 1965.

This region is dominated by the High Plains, a plateau produced by late Tertiary alluvial deposits. Quaternary deposits occur as alluvial terrace deposits along valleys, as basin fill, and as eolian deposits. These have been correlated with the Midwest glacial sequence by means of fossils, distinctive buried soils, terrace tracing, distinctive lithologic types, and radiocarbon dating. All four stages are represented by alluvial and basin fill deposits, and the two youngest by eolian. The deposits are named and described as rock stratigraphic units. Major interglacial intervals are represented by buried soils that are described as soil stratigraphic units.—*from* Authors' abstract

Fryxell, Roald. *See* Richmond, Gerald M. 3300

3167 **Furrer, M. A.** Paleontology of some limestones and calcphyllites of the Northern Range of Trinidad, West Indies [abs.]: Bol. Inf., v. 8, no. 3, p. 78, 1965.

3005 **Gaal, Robert.** Minerals from the sea: Los Angeles County Mus. Quart., v. 4, no. 2, p. 4–8, illus., 1965.

The possibilities of extracting metals from sea water are explored. Manganese and phosphorite nodules on the sea floor are discussed, and those off the coast of California mentioned. Other minerals occurring on bank-tops or in drowned beaches are glauconite, tin ore, gold, magnetite, and ilmenite. Salt, by evaporation, and petroleum under the continental shelves are included.—E.S.L.

Galusha, M. J. *See* Stucker, G. F. 2799

3279 **Gartner, Stefan, Jr.** A biostratigraphic study of the calcareous nannofossils of the Upper Cretaceous of the Northwestern Gulf Coast [abs.]: Dissert. Abs., v. 26, no. 5, p. 2687, 1965.

Gaydos, M. W. *See* Wasson, B. E. 2995

3274 **Gaze, Richard.** The physical and molecular structure of asbestos, *in* Biological effects of asbestos: New York Acad. Sci. Annals, v. 132, art. 1, p. 23–30, illus., tables, 1965.

General descriptions of the commercially important asbestos minerals—chrysotile, crocidolite, amosite, and anthophyllite—are given, and the chemical analyses, and physical properties tabulated. The molecular structure of chrysotile and amphibole asbestos is discussed briefly, and electron micrographs and schematic representations included.—E.S.L.

3187 **Geological Society of Iowa.** Pre Cedar Valley, post Maquoketa sediments, northeast Iowa—Field trip, May 22, 1965, Guide Book: [Iowa City] Geol. Soc. Iowa, 19 p., illus., 1965.

The main objective of the field trip was to review the correlation of stratigraphy in northern Fayette, southern and western Winneshiek, and eastern Howard Counties, Iowa, and to introduce some new ideas as to association of these beds. Emphasis is on sediments deposited in the time interval pre-Cedar Valley and post Maquoketa.—*from* Introduction

Giddings, J. L. *See* Péwé, Troy L. 3331

3173 **Giles, Robert T.; Pilkey, Orrin H.** Atlantic beach and dune sediments of the southern United States: Jour. Sed. Petrology, v. 35, no. 4, p. 900–910, illus., 1965.

Sand samples from beaches, dunes, and rivers on the southern Atlantic Coast of the United States were examined with respect to median grain size, sorting, percent calcium carbonate, and heavy and light minerals. Results indicate an assemblage of unstable heavy minerals in sands of beach, dune, and rivers draining piedmont, but not in those of rivers draining coastal plains only. Grain size in beach and dune sands is finest in Georgia, and coarser both in the north and south. It is controlled mainly by wave energy. Carbonate content, controlled by availability of material and by wave energy, is lowest in Georgia and highest to the south.—E.D.M.

Gimlett, J. I. *See* Slemmons, D. B. 3270

Golden, H. G. *See* Wasson, B. E. 2995

3247 **Goldthwait, Richard P.; Dreimanis, Aleksis; Forsyth, Jane L.; Karrow, Paul F.; White, George W.** Pleistocene deposits of the Erie Lobe, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 85–97, illus., tables, 1965.

The Erie lobe, fed by ice flow from north of Lake Ontario, followed the Ontario and Erie basins southwest into Indiana and central Ohio, with short lobes spreading into Pennsylvania and New York. Kansan, Illinoian, and Wisconsin glaciations in central and western Ohio are described and a map is included; Illinoian and Wisconsin advances in northeastern Ohio and northwestern Pennsylvania are discussed and the deposits tabulated; and Pleistocene glacial deposits of the southern fringe of Ontario, mostly Wisconsin age, are described, with a map to show end moraines and sites from which C-14 dates have been made. Retreat of the glacier produced a series of lake levels in the basins of Lake Erie and Ontario.—E.S.L.

3092 **Goodman, Richard Edwin.** The stability of slopes in cohesionless materials during earthquakes [abs.]: Dissert. Abs., v. 26, no. 5, p. 2635, 1965.

Grant, Richard E. *See* Kier, Porter M. 2815

Grant, Richard E. *See* Kier, Porter M. 2911

2770 **Gray, Jane.** Extraction techniques, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 530-587, 1965.

The recovery of acid-insoluble microfossils from sediments and sedimentary rocks generally includes four steps—cleaning, disaggregation and dispersal, chemical extraction, and density separation. Methods of cleaning are listed. Discussion on the second step is divided into mortar and pestle, ultrasonic generator, organic solvents, and dispersing agents. Chemical extraction is divided according to the type of material, with sections on general, inorganic, organic, and oxidized humic compounds. Most of the section on density separation is devoted to flotation, with the use of five heavy liquids described. Other separation methods used occasionally are mentioned.—E.S.L.

2817 **Gray, Jane.** Palynological techniques, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 471-481, 1965.

Sampling the different types of depositional environments for palynomorphs is discussed. Laboratory and study techniques are described, and the equipment and chemical reagents listed. The making of photomicrographs is considered also. E.S.L.

3280 **Gray, Lewis Richard.** Palynology of four Allegheny coals, northern Appalachian coal field [abs.]: Dissert. Abs., v. 26, no. 5, p. 2433-2434, 1965.

3069 **Greenberg, S. S.; Milici, R. C.** Petrography of the soapstone deposits near Old Dominion, Albemarle County, Virginia: Southeastern Geology, v. 6, no. 4, p. 213-218, illus., tables, 1965.

Approximately 200 samples were collected from the soapstone deposits and associated rocks, and were grouped into rock types by means of X ray analyses and thin section studies. Phyllites and metamorphosed graywackes of the Precambrian Lynchburg Formation enclose a metamorphosed sill that is about 900 feet thick. In this body hornblende oligoclase rock grades upward into rock consisting predominantly of hornblende, oligoclase, clinozoisite, and muscovite. Chlorite tremolite and chlorite talc rocks are the principal types of soapstone within the sill.—*from* Authors' abstract

2862 **Greene, Robert C.** Geologic map of the Kirksville quadrangle, Garrard and Madison Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ 452, scale 1:24,000, section, text, 1965.

Small amounts of crushed stone have been produced from the Garrard Siltstone and Calloway Creek Limestone in the Kirksville quadrangle. Large quantities of limestone suitable for road metal or concrete aggregate are available from the Calloway Creek and Lexington Limestones. A belt of structural highs extending

across the central part of the quadrangle may offer attractive sites for oil and gas exploration.—M.C.M.

2963 **Greene, Robert C.** Geologic map of the Richmond South quadrangle, Madison County, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-479, scale 1:24,000, section, text, 1966.

Large quantities of limestone suitable for road metal, concrete aggregate, or agricultural stone occur in the Stingy Creek and Gilbert Members and upper part of the Tate Member of the Ashlock Formation and in the Calloway Creek Limestone (Ordovician). The base of the latter is the best water producing horizon. There has been little exploration for oil and gas.—M.C.M.

Greensfelder, R. *See* Slemmons, D. B. 3270

3148 **Gremillion, L. Ray.** The origin of attapulgite in the Miocene strata of Florida and Georgia [abs.]: Dissert. Abs., v. 26, no. 3, p. 1590–1591, 1965.

3318 **Griffin, James B.** Late Quaternary prehistory in the northeastern woodlands, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 655–667, 1965.

Prehistoric Indians first occupied the southern part of the northeastern woodland area between circa 12,000 to 9,000 B.C. With the gradual withdrawal of the Wisconsin ice, they slowly occupied the entire area. They were contemporaries of late Pleistocene fauna, of a lowered sea level, of striking changes in the water level and drainage pattern of the Great Lakes, and of the slow changes in vegetation in the glaciated area. Since man lived close to the water level in the Great Lakes area, opportunity is provided for close correlations of successive prehistoric cultures with the changes in the lakes during postglacial times.—E.S.L.

3026 **Grimes, Walter W.** Geology and foundation problems of glacial drift in eastern South Dakota, *in* Highway geology symposium, 15th Ann., 1964, Proc.: Rolla, Missouri Div. Geol. Survey and Water Resources, p. 15–44, illus., table, 1964.

Geomorphology and glacial geology of eastern South Dakota are discussed. About 34,000 sq mi was covered by ice during the Wisconsinan glaciation; deposits of the Iowan, Tazewell, Cary, and Mankato substages are well represented in South Dakota and are correlated with those of adjoining States. Deposits of earlier (Nebraskan, Kansan, and Illinoian) glaciations and interglacial stages are tentatively identified, but correlation is uncertain. Three examples of highway foundation problems, in Marshall, Codington, and Minnehaha Counties, each in deposits of a different Wisconsinan substage, and their solutions, are discussed.—V.M.J.

3130 **Grolier, Maurice Jean.** Geology of part of the Big Bend area, in the Columbia Plateau, Washington [abs.]: Dissert. Abs., v. 26, no. 4, p. 2133, 1965.

Guilday, J. E. *See* Hibbard, C. W. 3335

2842 **Gupta, Indra N.** Standing wave phenomena in short period seismic noise: Geophysics, v. 30, no. 6, p. 1179–1186, illus., 1965.

Short-period vertical seismometers are used in deep holes at several sites to obtain the change with depth in amplitude and phase spectra of short-period seismic noise. Although the observed spectra can be explained by an arbitrary combination of several Rayleigh modes, an alternative theory is suggested here. An attempt is made to explain both amplitude and phase spectra of observed microseisms of period less than 6 sec in terms of standing-wave phenomena caused by steady-state plane harmonic compressional waves propagating vertically through a horizontally stratified medium. At most sites, the observed data indicate satisfactory agreement with the expected results. A considerable fraction of the short period noise may, therefore, be regarded as P-wave noise propagating vertically from below—Author's abstract

3293 **Guthrie, Daniel Albert.** The mammals of the Eocene Lysite Member, Wind River Formation of Wyoming [abs.]: Dissert. Abs., v. 26, no. 4, p. 2389, 1965.

Haase, R. J. *See* Seriff, A. J. 2841

3064 **Hackett, James E.** An application of geologic information to land use in the Chicago metropolitan area: Illinois Geol. Survey Environmental Geology Notes, no. 8, 6 p., tables, 1966.

To show how geology, land-use planning, and conservation of resources are interrelated, information has been abstracted from a detailed report of a planning study on the DuPage County Forest Preserve. Factors considered were: presence of mineral resources, occurrence of ground water, potential for surface water reservoirs, and suitability for disposal of wastes. It was concluded that excavation of sand and gravel resources would permit refashioning the landscape and developing recreational lakes in the pits in addition to providing water storage areas. The two drainage valleys that cross the County have the best mineral potential, and aquisition of the land would prevent urban encroachment in the river floodplain, keep accessible the mineral resources for local needs, institute a water management program, and provide water-based recreational facilities.—M.C.M.

2974 **Halbouty, Michel T.** Stratigraphic-trap possibilities in Upper Jurassic rocks, San Marcos Arch, Texas: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 3–24, illus., 1966.

The San Marcos arch has been a persistent positive area since Late Triassic or Early Jurassic time. Oil has accumulated in practically all types of structural and stratigraphic traps in this area, and is produced from numerous Upper Cretaceous and Tertiary strata. Stratigraphic and paleoenvironmental studies suggest that the Upper Jurassic and Lower Cretaceous strata should also contain favorable conditions for stratigraphic entrapment of hydrocarbons.—E.K.M.

2850 **Hall, D. H.; Brisbin, W. C.** Crustal structure from converted head waves in central western Manitoba: Geophysics, v. 30, no. 6, p. 1053–1067, illus., tables, 1965.

Deep seismic sounding along a line from Flin Flon to Mafeking, Manitoba, revealed the Conrad and M discontinuities. Even using a single shotpoint it was found possible to determine velocities, layer thicknesses, and structure using the interpretational possibilities of head waves. The Conrad discontinuity rises from 15.5 ± 1 km near Flin Flon to about 10 km near Mafeking, while the M discontinuity rises from 34 ± 1 km to 31 ± 1 km. Depths and densities related to the seismic model do not totally explain the observed gravity curve; this is believed to be due to the presence of masses of anomalous density within the granitic layer.—D.B.V.

3098 **Hall, Donald D.** Paleoecology and taxonomy of fossil Ostracoda in the vicinity of Sapelo Island, Georgia [abs.]: Dissert. Abs., v. 26, no. 5, p. 2687–2688, 1965.

2950 **Hamilton, E. I.** Distribution of uranium in some natural minerals: Science, v. 151, no. 3710, p. 570–571, illus., 1966.

The advantages of the fission method over conventional autoradiography for studying the distribution of uranium in natural minerals is described. Relatively high concentrations of uranium associated with micro inclusions in the St. Marks enstatite chondrite have been observed and may account for the variation of the uranium concentrations in different samples of this meteorite.—Author's abstract

3151 **Hamilton, Robert Morrison.** The effects of frequency, temperature, and pressure on the electrical conductivity of periclase [MgO] and olivine [$(Mg, Fe)_2SiO_4$] [abs.]: Dissert. Abs., v. 26, no. 3, p. 1591, 1965.

2868 **Hammer, Sigmund.** Density determinations by underground gravity measurements—Sequel: Geophysics, v. 30, no. 6, p. 113–1134, table, 1965.

McCulloh's findings (ibid., p. 1108–1132) are confirmed by independent gravity measurements in the same mine (at Barberton, Ohio), using a different instrument—a Worden No. 72.—D.B.V.

3152 **Hammes, Richard Robert.** Stratigraphy of the Wesley Formation (Mississippian), western Ouachita Mountains, southeastern Oklahoma [abs.]: Dissert. Abs., v. 26, no. 3, p. 1591, 1965.

3014 **Hanshaw, Bruce B.; Zen, E-An.** Osmotic equilibrium and overthrust faulting: Geol. Soc. America Bull., v. 76, no. 12, p. 1379–1386, 1965.

Field data, experimental studies and theoretical considerations indicate that the lubrication effect needed for large scale shallow-angle thrust faulting, as treated in the Hubbert-Rubey hypothesis, may be derived from osmotic effects in shale-bearing sections containing evaporites. Osmotic formation pressures as high as 500 bars are readily possible, corresponding to a depth of burial of about 4 km for water-saturated sediments.—J.J.H.

3226 **Hardie, Lawrence Alexander.** Phase equilibria involving minerals of the system $CaSO_4$–Na_2SO_4–H_2O [abs.]: Dissert. Abs., v. 26, no. 6, p. 3246–3247, 1965.

3275 **Harington, J. S.** Chemical studies of asbestos, *in* Biological effects of asbestos: New York Acad. Sci. Annals, v. 132, art. 1, p. 31–47, tables, 1965.

Further chemical studies were made on crocidolite, amosite, and chrysotile. The origin of the primary oils associated with crocidolite and amosite is discussed. Crocidolite yields .32 percent extractable material, and amosite, .28 percent. The chemical composition and trace element analysis of the three varieties are tabulated.—E.S.I.

3143 **Harris, DeVerle Porter.** An application of multivariate statistical analysis to mineral exploration [abs.]: Dissert. Abs., v. 26, no. 4, p. 2247, 1965.

3282 **Harrison, W.; Wass, Marvin L.** Frequencies of infaunal invertebrates related to water content of Chesapeake Bay sediments: Southeastern Geology, v. 6, no. 4, p. 177–187, illus., tables, 1965.

A linear model was used in a least squares search for significant combinations of independent variables. While the investigator can make subjective judgments as to the environments preferred by organisms, careful determinations of the environmental variables, coupled with analytical techniques like the one used here, can more accurately suggest species requirements. The importance of water content is suggested by its repeated appearance as an influential independent variable. It would seem wise to provide for careful measurement of this variable in future studies of animal-sediment relationships.—E.S.I.

3101 **Harriss, Robert Curtis.** Geochemical and mineralogical studies on the weathering of granitic rocks [abs.]: Dissert. Abs., v. 26, no. 5, p. 2688, 1965.

Hartshorn, J. H. *See* Schafer, J. P. 3249

3186 **Haught, Oscar L.** Geology of oil and gas: West Virginia Geol. and Econ. Survey Circ. 3, 31 p., illus., 1965.

In this speech prepared for an institute on oil and gas law, Haught explains the origin of oil and gas and how they are held in rocks and move through rocks; general geology of West Virginia including a Cambrian–Pennsylvanian stratigraphic section; productive formations in the State; how oil and gas are obtained and refined; gas production and storage; history of oil and gas; and future prospects in West Virginia.—M.C.M.

3153 **Hawley, Charles Caldwell.** Geology of the Pikes Peak Granite and associated ore deposits, Lake George beryllium area, Park County, Colorado [abs.]: Dissert. Abs., v. 26, no. 3, p. 1592, 1965.

2895 **Hay, William W.** Calcareous nannofossils, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 3–7, 1965.

Calcareous nannofossils have been divided into two main groups, heliolithid and ortholid forms, which are described. Both collecting and sample-preparation techniques are given.—E.S.L.

2973 **Hayes, Miles Oren.** Sedimentation on a semiarid, wave-dominated coast (south Texas) with emphasis on hurricane effects [abs.]: Houston Geol. Soc. Bull., v. 8, no. 6, p. 21–22, 1966.

Hayes, W. E. *See* Scott, K. R. 2915

3154 **Haynes, Caleb Vance, Jr.** Quaternary geology of the Tule Springs area, Clark County, Nevada [abs.]: Dissert. Abs., v. 26, no. 3, p. 1592–1593, 1965.

2880 **Heagler, John B., Jr.** Clay mineralogy and soil stabilization, *in* Highway geology symposium, 15th Ann., 1964, Proc.: Rolla, Missouri Div. Geol. Survey and Water Resources, p. 133–[145], 1964.

Colloid chemistry of clay minerals and structures of clay particles are discussed briefly, with emphasis on the surface energy (Zeta Potential) concept. Physical properties of clay soils such as high plastic index and low shrinkage limit are associated with the dispersed (high-energy) structure; low plastic index is associated with the flocculated (low-energy) structure. Small additions of the proper chemical can have rather large effects on the Zeta Potential and the properties of the soil. High plasticity of a clay soil can be decreased by addition of a flocculant, such as hydrated lime, which also changes the shear characteristics. Changes in potential and loss of stability can be caused by natural leaching action; fortunately, chemical additives can perform other stabilization functions in a soil besides the Zeta Potential changes.—V.M.J.

Heidrick, Tom. *See* Brokaw, Arnold L. 2962

Heizer, Robert F. *See* Hole, Frank. 3211

2859 **Helz, G. R.; Holland, H. D.** The solubility and geologic occurrence of strontianite: Geochim. et Cosmochim. Acta, v. 29, no. 12, p. 1303–1315, illus., tables, 1965.

The solubility of natural strontianite was measured at 50°, 100°, and 200°C in aqueous solutions in equilibrium with a vapor phase containing CO_2 at pressures between 1 and 50 atm. Results show that precipitation of strontianite can take place only when the ratio $m_{Sr}+2/m_{Ca}+2$ in solution is well in excess of its normal range in natural waters, and that the precipitation of strontianite in geologic settings is more unlikely at high than at low temperatures. The conditions required for the deposition of strontianite can be obtained by preferential solution of celestite or barite or as a result of recrystallization of high-Sr aragonite to low-Sr calcite.—D.B.V.

2902 **Henderson, J. F.** (compiler). Current research in the geological sciences in Canada, June, 1963–May, 1964: Canada Natl. Advisory Comm. Research Geol. Sci., 14th Ann. Rept. 1963–64, 191 p., paged separately, 1965.

Research projects listed have been obtained from universities, federal and provincial departments of mines, and other non-industrial institutions carrying on research in geological sciences in Canada. Projects are grouped under main geological headings, and the author index indicates the number of the project in the bibliography.—M.C.M.

3273 **Hendry, N. W.** The geology, occurrences, and major uses of asbestos, *in* Biological effects of asbestos: New York Acad. Sci. Annals, v. 132, art. 1, p. 12–21, tables, 1965.

Chrysotile asbestos amounts to over 90 percent of the total asbestos output. The deposits occur in serpentine formed by hydrothermal alteration of ultrabasic rocks. Types of occurrence are described. Crocidolite and other amphibole asbestos are mentioned. Properties of the six varieties are shown in a table. Total production of all types of asbestos is discussed by countries, and major uses are listed.—E.S.L.

3002 **Henshaw, Paul C.** Exploration for lead in Southeast Missouri: Mining Cong. Jour., v. 51, no. 12, p. 28–30, illus., 1965.

Recent discoveries of ore in extensions of the Lead Belt, southeastern Missouri, are mostly in the basal 200 feet of the Bonneterre Dolomite of Upper Cambrian age. Metallization was localized where the Bonneterre was cut by faults and was thinned along the flanks of buried knobs and ridges of the Precambrian basement, especially where it overlies the Lamotte Sandstone. The paleoenvironment of the Bonneterre in this area is considered to be a lagoon, fringed by reefs. The ore formed as veinlets and replacement bodies in fractured and brecciated dolomite in these facies. Recognition of paleophysiography is an aid to exploration. Production to date totals more than a billion dollars of lead; properties being developed should greatly increase this total.—R.J.R.

Heron, S. Duncan, Jr. *See* Atlantic Coastal Plain Geol. Assoc. 2982

Herrick, E. H. *See* Hood, James W. 2906

3302 **Heusser, Calvin J.** A Pleistocene phytogeographical sketch of the Pacific Northwest and Alaska, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 469–483, illus., table, 1965.

When uplift of the western cordillera occurred in late Tertiary and Pleistocene time, vegetation began to take on the broad aspects of its present distribution. Repeated glaciation further contributed toward molding the modern units. Late-glacial and postglacial vegetation is reconstructed on palynological grounds. Pollen diagrams and a chart showing the late-glacial and postglacial vegetation are included.—E.S.L.

3033 **Hewitt, P. C.; McClennan, William E., Jr.; Nilsson, Harold.** Geologic phenomena in the Schenectady area, Field trip D, *in* Field trips in the Schenectady area—New York State Geol. Assoc., 37th Ann. Mtg., Union Coll., 1965, Guidebook: New York, City College of City Univ. of New York, Dept. Geology, p. D1–D13, 1965.

Features discussed are the Clifton Park anticline, Geyser Park, and Stark's Knob. The anticline appears to be an asymmetrical fold plunging to the southwest and cut by faulting. The "geysers" in the Saratoga Springs area are actually drilled wells, but flowing free. The water is highly mineralized and tufa deposits formed are described. An analysis of the water is included, and the possible source of minerals and gas is discussed. Stark's Knob, north of Schuylerville, N. Y., is a mass of basalt about 200 feet high surrounded by Normanskill shales. The petrology and structure are discussed and some theories of its origin mentioned.—E.S.L.

3335 **Hibbard, C. W.; Ray, D. E.; Savage, D. E.; Taylor, D. W.; Guilday, J. E.** Quaternary mammals of North America, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 509–525, illus., tables, 1965.

The basic data of stratigraphic ranges (177 genera) and geographic occurrences (104 localities) are summarized. Most of the text is devoted to discussion of promising avenues for future research and examples of the kinds of synthetic study that have proved fruitful. Faunal shifts correlated with glacial-interglacial climatic changes have been documented thoroughly only in the Great Plains, and are shown on a chart. Probably all Recent mammalian species originated during the Quaternary, but generic change was by extinction rather than evolution. Major faunal sites and distribution of certain species are shown on maps. Late Pliocene and Pleistocene genera are tabulated, arranged according to first appearance.—E.S.L.

2960 **Hibbert, F. A.; Eggert, D. A.** A new calamitalean cone from the Middle Pennsylvanian of southern Illinois: Palaeontology, v. 8, pt. 4, p. 681–686, illus., 1965.

A new species of the genus *Paracalamostachys* is described. The holotype consists of a group of cones found in an ironstone nodule in the Pennsylvanian Carbondale Formation near Carterville.—E.S.L.

2944 **Hidore, John J.** Landform characteristics affecting watershed yields on the Mississippi Missouri interfluve: Oklahoma Acad. Sci. Proc. 1964, v. 45, p. 201–203, illus., 1965.

Eight landform characteristics were calculated and their association with runoff determined. These characteristics are: shape of watershed, stream order, erosional stage, average slope, median elevation, average length of overland flow, average length of first order streams, and stream density. Most of these failed to show any significant effect on runoff for the time periods analyzed.—E.S.L.

Higgins, G. E. *See* Ablewhite, K. 3277

2985 **Hinson, Hillord.** Wyckliff Riley Foxworth (1936–1965): Houston Geol. Soc. Bull., v. 8, no. 5, p. 13, portrait, 1966.

2997 **Hirashima, George T.** Effects of water withdrawals by tunnels, Waihee Valley, Oahu, Hawaii: Hawaii Div. Water and Land Devel. Rept. 28, 38 p., illus., tables, 1965.

One of the two ground water reservoirs in the Waihee Valley is controlled by the 6 ft dike at the falls near the head of the Valley and the other by a 12 ft dike at the upper end of the Waihee water development tunnel. The discharge response to heavy rains is different for the two reservoirs owing to their differences in geology and topography; ground water discharge from the falls reservoir lags several weeks behind that of the tunnel reservoir. Proposed vehicular or water development tunnels bored into the falls reservoir will affect the discharge from and storage in the Koolau Range in general and of the Waihee Valley area in particular. *from* Author's abstract

3171 **Hodgkinson, Kenneth Allred.** The late Paleozoic ammonoid families, Prolecanitidae and Daraelitidae [abs.]: Dissert. Abs., v. 26, no. 5, p. 2688, 1965.

3227 **Hoffer, Jerry Martin.** Plagioclase variations in a porphyritic flow of the Columbia River basalt [abs.]: Dissert. Abs., v. 26, no. 6, p. 3247, 1965.

2793 **Hofker, Jan.** Methods for study and preparation of Foraminifera, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 251–256, 1965.

The study of dry tests is rather unsatisfactory. Castor oil has been found to be a good fluid clarifier. Other miscellaneous techniques described are making slides of larger Foraminifera and sectioning small ones, making drawings of a series of sections, study of canal systems, and extraction by decanting.—E.S.L.

3211 **Hole, Frank; Heizer, Robert F.** [Dating the events] Chap. 10–12 *in* An introduction to prehistoric archeology: New York, Holt, Rinehart and Winston, p. 145–174, illus., 1965.

Chapter 10 covers dating by physical chemical methods, and includes radiocarbon and other radioactive methods, magnetic dating, chemical analysis, patination, and hydration of obsidian. Geochronology is discussed in Chapter 11, and includes varve analysis, beaches terraces dunes, correlation of Pleistocene features, rate of sedimentation, and location of archeological sites. The remaining chapter describes methods that use plant and animal remains, including palynology, paleontology, and dendrochronology.—E.S.L.

Holland, H. D. *See* Helz, G. R. 2859

2947 **Holland, H. D.; Borcsik, Maria.** On the solution and deposition of calcite in hydrothermal systems, *in* Symposium—Problems of postmagmatic ore deposition

with special reference to the geochemistry of ore veins, Prague, 1963, V. 2: Prague, Geol. Survey of Czechoslovakia, p. 364–374, illus., 1965.

The solubility of calcite should first be studied in simple hydrothermal solutions, and components added until the complexity of an ore forming fluid is approached. The solubility of calcite in water at varying temperatures is shown diagrammatically and discussed. Next the effect of NaCl concentration is tested and the results found to be unchanged. Calcium chloride was also found to have very little effect. In order to determine the factors that controlled carbonate mineralogy in each particular ore body, study of the liquid inclusions is suggested.—E.S.L.

2791 **Honjo, Susumu; Fischer, Alfred G.** Thin sections and peels for high magnification study and phase contrast microscopy, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 241–247, illus., 1965.

The microscopic study of rocks and skeletal materials at higher magnifications requires differently prepared objects, polished surfaces, peel replicas of polished and etched surfaces, or ultra thin sections. Preparation and study of the last two are described.—E.S.L.

2882 **Honjo, Susumu; Fischer, Alfred G.** Paleontological investigation of limestones by electron microscope, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 326–334, illus., 1965.

To date, electron microscopy has dealt mainly with microfossils in unconsolidated sediments, separated from matrix, but a survey started on fine grained limestones shows that they may contain thousands of fossils that are unrecognizable by optical study. At present, electron microscopy must be done on bulk limestone, so methods are presented for obtaining a polished surface with minimal disturbance of fabric, for finely etching this surface to bring fabric into relief, and for preparing two-stage replicas.—E.S.L.

2906 **Hood, James W.; Herrick, E. H.** Water resources of the Three Rivers area, Otero and Lincoln Counties, New Mexico: U.S. Geol. Survey Hydrol. Inv. Atlas HA-192, scale 1:126,720, text, 1965.

The map sheet includes a geologic map, and maps showing contours on the water table, depth of wells, depths to water, and yield of wells, and chemical quality of ground water. Principal aquifers are alluvium of Quaternary age, beds of sandstone in the lower Cub Mountain Formation, and the upper Mesaverde Group. Older formations probably contain highly mineralized water. Most water from wells and springs is of fair to very poor quality for municipal or domestic use. Ground water is largely of calcium magnesium sulfate type, and the sulfate content generally governs its potability. The best aquifer is the Quaternary alluvium.—M.C.M.

2807 **Hooper, Kenneth.** Analytical techniques applied to fossils and shells, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 360–383, illus., tables, 1965.

This paper reviews some of the modern analytical techniques for fossils and shells in very general terms. Methods covered are microchemical tests, staining, colorimetric methods, flame photometry, atomic absorption spectrophotometry, thermoluminescence, optical and laser emission spectrography, X ray diffraction and absorption, fluorescent X ray spectrography, electron probe X ray microanalysis, and mass spectrometric and radiometric analysis.—E.S.L.

2881 **Hooper, Kenneth.** X ray microscopy in morphological studies of microfossils, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 320–326, illus., 1965.

Because it is a rapid method of getting detailed information and high accuracy measurement of internal structures without destroying the fossil, X ray microscopy is particularly useful in studies where biometrical and statistical analyses are planned. Methods are divided into reflection, contact, and point-projection.—E.S.L.

Hopkins, David M. *See* Péwé, Troy L. 3331

3131 **Horowitz, Daniel Henry.** Petrology of the upper Ordovician and lower Silurian rocks in the central Appalachians [abs.]: Dissert. Abs., v. 26, no. 4, p. 2134, 1965.

2774 **Hotton, Nicholas, 3d.** Tetrapods, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 119–125, 1965.

Tetrapods first appeared in terrestrial shales and sandstones of Mississippian age, and are found in deposits of every period since that time. Techniques of search, collection, and preparation are determined by the relationship between hardness of matrix and of bone. Excavation techniques are discussed in detail.—E.S.L.

3213 **Houng, Kun-Huang.** A study on the soils containing amorphous materials in the Island of Hawaii [abs.]: Dissert. Abs., v. 26, no. 6, p. 2968, 1965.

3048 **Howe, W. B.** Digitate algal stromatolite structures from the Cambrian and Ordovician of Missouri: Jour. Paleontology, v. 40, no. 1, p. 64–77, illus., 1966.

Oolitic and dolarenitic facies of Upper Cambrian and Lower Ordovician formations in Missouri contain abundant algal stromatolites, which are digitate in vertical section and meandrine to subcircular in plan view. Environmental factors and problems of classification are discussed. Application to these structures of the names *Collenia* or *Gymnosolen* is decried, and use of simple descriptive terms is supported. Thus the term "digitate stromatolite" is used for the structures under discussion.—S.H.M.

Huebner, J. S. *See* Sawkins, F. J. 2924

2901 **Huffman, George G.** Stratigraphy and structure of the Oklahoma Ozark area, *in* North eastern Oklahoma—Kansas Geol. Soc., 28th Field Conf., 1964, Guidebook: Wichita, Kans., Kansas Geol. Soc., p. 5–19, illus., 1964.

The rock sequence from the Precambrian granite through the Pennsylvanian McAlester Formation is discussed, with notes on the paleontology. A section on structure describes the regional picture and discusses the tectonic history; major structures are listed and shown on a map.—E.S.L.

3121 **Hutcheson, Harvie Leon, Jr.** Vegetation in relation to slope exposure and geology in the Arbuckle Mountains [abs.]: Dissert. Abs., v. 26, no. 4, p. 1880–1881, 1965.

3324 **Hutton, C. Osborne.** Weddellite in modern sediments, Florida: Mineralog. Mag., v. 34, no. 268, p. 256–265, tables, 1965.

Crystallographic data are given for euhedra of weddellite from recent sediments collected off the southeastern coast of Florida at depths ≤ 1 fathom. Heat treatment of samples produced whewellite, calcite, and calcium oxide in turn as higher temperatures were employed. X ray diffraction data are given for weddellite, and d spacings and intensities for whewellite. It is suggested that weddellite in these calcareous sediments is not a primary occurrence but developed over the period of two years during which the sediment samples were stored. The question is raised as to whether weddellite was present in the Weddell Sea sediments at the actual time of recovery by the Scotia Expedition.—V.S.N.

3145 **Hwang, Li-San.** Flow resistance of dunes in alluvial streams [abs.]: Dissert. Abs., v. 26, no. 4, p. 2112, 1965.

3004 **Hyden, Harold J.** Geologic map of the Pierce Reservoir quadrangle, Albany and Carbon Counties, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ 510, scale 1:24,000, section, text, 1966.

Known mineral resources in the Pierce Reservoir quadrangle are oil, gas, coal, and gravel. Oil is produced from the Cloverly Formation, the Muddy Sandstone Member of the Thermopolis Shale, and Sundance Formation, and natural gas from

a sandstone zone in the upper part of the Steele Shale. The Foote Creek Formation and the Pine Ridge Sandstone Member of the Mesaverde Formation contain coal of subbituminous grade. Terrace gravel deposits, quarried for road metal, cover large areas of the quadrangle.—M.C.M.

3022 **Hyden, Harold J.** Geologic map of the Rock River quadrangle, Albany County, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ-472, scale 1:24,000, section, text, 1965.

Coal beds one to 3.5 feet thick are exposed along the outcrop of the Pine Ridge Sandstone Member of the Mesaverde Formation, and beds of greater thickness in this Member have been exploited by mining operations, but no mines have been operative since the mid-1930's. Small pods and lenses of coal occur in the Dutton Creek Formation. West of the Rock River quadrangle structural traps have produced oil from reservoirs in the Sundance, Cloverly, and Thermopolis Formations and gas in the upper part of the Steele Shale. These formations are present below the surface of the Rock River quadrangle and additional data may indicate favorable structural features. Terrace gravel deposits have been quarried near the town of Rock River.—M.C.M.

Ingalls, Arthur L. *See* Dobrin, Milton B. 2843

2930 **Ingerson, Earl.** The concept of a separable pneumatolytic stage in post-magmatic ore formation, *in* Symposium—Problems of postmagmatic ore deposition with special reference to the geochemistry of ore veins, Prague, 1963, V. 2: Prague, Geol. Survey of Czechoslovakia, p. 463-471, illus., 1965.

Pneumatolysis originally meant "decomposition by volcanic gases". Extension of the term to include formation of deep-seated ore deposits was based partially on lack of understanding of the properties of gaseous solutions. Water is the dominant solvent in ore-forming solutions. Under sufficient pressure to give them requisite density, solvents can dissolve as much non-volatile material above their critical temperatures as at any sub-critical temperature. Therefore, none of the criteria that have been proposed for recognizing the agency of gases in mineral formation is valid. For these reasons the term *pneumatolytic* as applied to ore deposits should be abandoned.—*from* Author's summary

3035 **Isachsen, Yngvar W.** Geologic excursion from Albany to the Glen via Lake George [Trip B], *in* Field trips in the Schenectady area—New York State Geol. Assoc., 37th Ann. Mtg., Union Coll., 1965, Guidebook: New York, City College of City Univ. of New York, Dept. Geology, p. B1-B17, illus., geol. maps, 1965.

This guide describes briefly the geology of the Adirondack region as a whole, and presents the lithologies, structures, and preglacial drainage along the excursion route in the southeastern Adirondacks. Tectonic and geologic maps accompany the text, and the geologic history is tabulated.—E.S.L.

2888 **Isham, Lawrence B.** Preparation of drawings for paleontologic publications, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 459-468, illus., 1965.

A good illustration of a fossil is one in which outline and shadow are correctly located and rendered. Preliminary drawing, general shading, stipple drawings, line shading, the use of scratchboard and stipple board, bleaching inked photographs, pencil shading, and retouching of photographs are considered.—E.S.L.

2844 **Ivanhoe, I. F.** Conversion of electric logs for seismic time sections: Geophysics, v. 30, no. 6, p. 1141-1143, illus., 1965.

Many of the most common scale-conversion problems can be minimized if electric well logs are converted from "depths" to "time" wherever the wells have been surveyed for velocity, and the "time electric logs" are posted conspicuously on the seismic sections. Electric log scale conversions, including velocity changes, can be accomplished readily by a simple adaptation of the "rubber-sheet technique" used by geologists in steeply dipping areas. An example is given of the conversion of

two reduced electric logs from scale 1:5,000 to a seismic record section of vertical scale 0.1 sec = 3/4 inch.—D.B.V.

Iversen, J. *See* Faegri, K. 2891

3198 **Jackson, Togwell A.** Power-spectrum analysis of two "varved" argillites in the Huronian Cobalt Series (Precambrian) of Canada: Jour. Sed. Petrology, v. 35, no. 4, p. 877–886, illus., 1965.

Thickness of varve couplets were measured at two outcrops and the distribution of thicknesses analysed by power- (variance-) spectrum statistics. No significant periodicity was found relating varve thickness to the sun-spot cycle or other cycles.—H.A.T.

3074 **James, Harold L.** Chemistry of the iron-rich sedimentary rocks, Chap. W *in* Data of geochemistry, 6th ed.: U.S. Geol. Survey Prof. Paper 440-W, p. W1–W60, illus., tables, 1966.

The character, composition, and occurrence of iron minerals found in sedimentary rocks are reviewed. Exhalative-sedimentary origins and origin by weathering processes are discussed with references to possible examples. Tables give analyses for various iron minerals and iron-bearing sediments, list occurrences of iron-rich sedimentary rocks by geologic era and geographically for the Precambrian, and list element contents of various ores and sediments.—V.S.N.

3292 **Joerger, Arthur Peter.** Coccolithophorids and related nannoplankton from the Upper Eocene to Middle Oligocene of southwestern Alabama [abs.]: Dissert. Abs., v. 26, no. 3, p. 1593, 1965.

3334 **Johnson, Albert W.; Packer, John G.; Reese, Gerd.** Polyploidy, distribution, and environment, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 497–507, illus., tables, 1965.

From 1/3 to 1/2 of the angiosperms so far investigated are polyploid, and this is taken as evidence that polyploidy has played an important evolutionary role in this group. In the northern hemisphere, the frequency of polyploidy increases with latitude. Several reasons are suggested for this, based on the survival ability of the polyploid species. More studies are necessary to determine whether the existence of high polyploid frequencies in high latitudes is due to evolution and spread in response to Quaternary physical changes, or whether there has been too little time since the last glaciation for equilibrium to be reached.—E.S.L.

2932 **Johnson, Arnold I.** Determination of hydrologic and physical properties of volcanic rocks by laboratory methods, *in* Dr. D. N. Wadia Commemorative Volume: Calcutta, India, Mining, Geol. and Metall. Inst. India, p. 49–66, illus., tables, 1965.

Analytical methods used in the Denver, Colo., Hydrologic Laboratory of the U.S. Geological Survey are briefly described, and hydrologic and physical properties data presented for samples of volcanic rock from near Los Alamos, N. Mex., Arco, Idaho, Mercury, Nev., and Eniwetok, Marshall Islands. In a thick formation of considerable areal extent characteristics such as joints, fractures, interflow sediments, and open spaces between flows may have great influence on the quantitative hydrology even though the permeability and effective porosity of the rocks themselves are low. However, for the analysis of a hydrologic problem, it is important to know these properties of the rocks as well as of the formational unit.—G.D.C.

Johnson, P. W. *See* Kister, L. R. 3087

3009 **Johnston, Robert B.; McLennan, Mrs. E. J.** Robert Angus Alister Johnston, 1867–1962: Royal Soc. Canada Minutes Proc., 4th ser., v. 3, p. 111, portrait, 1965.

Jones, A. E. *See* Slemmons, D. B. 3270

3325 **Joplin, Germaine A.** The problem of the potash-rich basaltic rocks: Mineralog. Mag., v. 34, no. 268, p. 266–275, tables, 1965.

Inquiry is made into the original meaning of the term latite, applied by Ransome (1898) to a group of lavas originally identified as basalts in the Sierra Nevada. It is suggested that the name latite be rejected and shoshonite magma-type be used for the potash-rich magma type from which monzonites, potash-rich syenites, lamprophyres, nepheline monzonites, shonkinites, covites, ijolites, leucite basalts, leucitophyres, and the like, have crystallized. Compositions are tabulated for the shoshonite series of Yellowstone Park and the Sierra Nevada, and for a similar series from eastern Australia.—V.S.N.

3190 **Jopling, Alan V.** Hydraulic factors controlling the shape of laminae in laboratory deltas: Jour. Sed. Petrology, v. 35, no. 4, p. 777–791, illus., 1965.

Variations in the frontal profile of laboratory deltas were determined in a series of controlled flume experiments. Principal variables isolated were stream velocity and bed shear stress, depth-ratio and sediment type. The base of the frontal profile was found to evolve from angular to incipiently tangential, to tangential, to strongly tangential, to low angle concave, as velocity and depth-ratio increased. Wave action and small oscillations of base level sometimes formed convex or S-shaped frontal profiles.—E.D.M.

Judson, Sheldon. *See* Richards, Horace G. 3250

3296 **Kadib, Abdel-Latif Abdullah.** A function for sand movement by wind [abs.]: Dissert. Abs., v. 26, no. 3, p. 1544, 1965.

3228 **Kaesler, Roger LeRoy.** A quantitative re-evaluation of the ecology and distribution of Recent Foraminifera and Ostracoda of Todos Santos Bay, Baja California, Mexico [abs.]: Dissert. Abs., v. 26, no. 6, p. 3247–3248, 1965.

3194 **Kahle, Charles F.** Strontium in oolitic limestones: Jour. Sed. Petrology, v. 35, no. 4, p. 846–856, illus., 1965.

Petrography and strontium content of 62 samples of oolitic limestone from many parts of the world were studied systematically. Strontium content of carbonates decreases with age. Apparently strontium is lost during diagenesis and this loss may be related to conversion of aragonite to calcite. Maximum loss of strontium occurs before any major episode of cementation. The percentage of strontium in ancient oolites may not be related to recrystallization but strontium is about twice as abundant in cement as in allochems in ancient sediments.—G.O.B.

3076 **Kansas Geological Society; Oklahoma Geological Survey; Oklahoma University School of Geology.** North-eastern Oklahoma—Kansas Geol. Soc., 28th Field Conf., Oct. 1964, Guidebook: Wichita, Kans., Kansas Geol. Soc., 77 p., illus., 1964.

Geologic sketch maps and photographs of sections accompany the road log of the two day field trip, whose principal objectives were an intensive study of the pre-Chattanooga stratigraphy, along with observation of the crinoidal bioherms of the upper St. Joe Group. A paper by G. C. Huffman on the stratigraphy and structure of the area is cited separately.—E.S.L.

Karrow, Paul F. *See* Goldthwait, Richard P. 3247

2782 **Kauffman, Erle G.** Collecting in concretions, nodules, and septaria, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 175–184, 1965.

Accretionary structures are important sources of well-preserved fossils. They occur throughout the geologic column in nearly all types of sedimentary rocks. The structure and origin of fossiliferous accretionary masses is discussed under the three types. Collecting techniques are divided into equipment, finding accretions, their characteristics, and related techniques.—E.S.L.

Kauffman, Erle G. *See* Sohl, Norman F. 2823

Kennedy, J. E. *See* Saunders, J. B. 3278

2785 **Kermack, K. A.** Problems of collecting from fissures, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 203–206, 1965.

Examples of fissure deposits of various ages are given, mostly European; caves as well as fissures are included. Possible methods by which the bones got into the fissures are discussed. Fossils found within fissures and caves have been protected from crushing and distortion, and their degree of mineralization tends to be low. The preparation of such fragile material calls for chemical methods, using formic and acetic acid.—E.S.L.

Kerr, Paul F. *See* Megrue, George H. 3012

2815 **Kier, Porter M.; Grant, Richard E.; Yochelson, Ellis L.** Whitening fossils, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 453–456, 1965.

Several methods for applying to fossils the two most common whiteners, ammonium chloride and magnesium oxide, are described. Antimony tetroxide is also mentioned.—E.S.L.

2911 **Kier, Porter M.; Grant, Richard E.** Echinoid distribution and habits, Key Largo Coral Reef Preserve, Florida: Smithsonian Misc. Colln., v. 149, no. 6, 68 p., illus., 1965.

Seventeen species of echinoids were found between the shore and a depth of 110 feet seaward from the living reef. They seem to show definite habitat preferences that could provide significant clues to paleoecologic interpretation, and also could be valuable to the modern ecologist or sedimentologist who retrieves samples by dredge or trawl. Many of the species that live in the Coral Reef Preserve occur as fossils, and others have near relatives that are known from Tertiary and Quaternary formations. Factors controlling distribution, and species that are controlled by each are discussed.—E.S.L.

3284 **King, Philip B.** Tectonics of Quaternary time in Middle North America, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 831–870, illus., 1965.

The tectonic features and events of Quaternary time are varied and have different causes, which include: isostatic depressions and uplifts following continental glaciation, and forming of large lakes; epeirogenic uplifts of broad parts of the continent, reactivating old structural trends as shown by earthquake epicenter patterns; downwarping accompanying sedimentation; block faulting; volcanism, probably related to deep-seated zones of crustal weakness; orogenic deformation produced by tangential forces; and emergence and submergence along the coast, mostly due to eustatic changes in sea level.—E.S.L.

3124 **King, Robert Nephew.** The earth on which we live—A sourcebook for the *Modern Elementary School Science* program of the Science Manpower Project [abs.]: Dissert. Abs., v. 26, no. 4, p. 1993, 1965.

2968 **Kirby, J. R.; Petty, A. J.** Regional aeromagnetic map of western Lake Superior and adjacent parts of Minnesota, Michigan and Wisconsin: U.S. Geol. Survey Geophys. Inv. Map GP-556, scale 1:250,000, 1966.

3087 **Kister, L. R.; Brown, S. G.; Schumann, H. H.; Johnson, P. W.** Maps showing fluoride content and salinity of ground water in the Willcox basin, Graham and Cochise Counties, Arizona: U.S. Geol. Survey Hydrol. Inv. Map HA-214, 2 sheets, scales 1:125,000 and 1:250,000, separate text, 1966.

The three maps show: distribution of fluoride in ground water, source rocks, and movement of ground water in 1910; distribution of dissolved solids in ground water, 1910; and distribution of dissolved solids in ground water, 1962, and changes of water table, 1910–1963. In most of the Willcox basin ground water is of good chemical quality, but in the playa area, it contains large amounts of dissolved solids and excessive fluoride. The fluoride comes from solution of fluoride-bearing minerals in Tertiary volcanic rocks or Precambrian schist, and water associated with weathering products derived from the other two. The salinity pattern which has changed markedly since 1910 is discussed and illustrated on one of the maps. M.C.M.

2965 **Kistler, Ronald W.** Geologic map of the Mono Craters quadrangle, Mono and Tuolumne Counties, California: U.S. Geol. Survey Geol. Quad. Map GQ-462, scale 1:62,500, sections, 1966.

The map sheet includes a table of modal analyses of granitic rocks and ternary diagrams of mineral compositions of the major granitic units in the Mono Craters quadrangle.—M.C.M.

Klein, Richard M. *See* Prance, Ghillean. 2898

3102 **Knapp, William Dale.** Mississippian cephalopods of the eastern interior United States [abs.]: Dissert. Abs., v. 26, no. 5, p. 2688–2689, 1965.

2975 **Koch, John G.** Late Mesozoic stratigraphy and tectonic history, Port Orford–Gold Beach area, southwestern Oregon coast: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 25–71, illus., 1966.

Upper Jurassic Galice Formation of interbedded argillite, mudstone, graywacke and fine conglomerate, deposited in Fraser Belt eugeosyncline, was folded and metamorphosed to schists of Colebrooke Formation (greenschist facies) during Nevadan orogeny; the Pearse Peak Diorite implaced; and the ancestral Klamath Mountains and Sierra Nevada became an important source area. Eugeosynclinal conditions persisted into latest Jurassic when Otter Point Formation of interbedded volcanics, cherts, sandstones, and mudstones was deposited. The eugeosyncline was terminated by Diablan orogeny, which imposed northwest-striking wrench faults and folds on northeast-striking Nevadan structures; diorites, gabbros and ultramafics were implaced. The Lower Cretaceous Humbug Mountain conglomerate and later Rocky Point Formation were deposited in transgressing sea followed by several orogenies until early Miocene when marine clastics deposited followed by regional uplift and faulting.—S.P.S.

Koenig, J. *See* Slemmons, D. B. 3270

2889 **Koenig, John W.** The Ro-Tap as an aid in sample preparation, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 275–276, 1965.

A rapid method of processing microfossil samples by adding potassium hydroxide and oscillating on a Ro-Tap sieve shaker is given.—E.S.L.

Konizeski, R. L. *See* Wood, Albert E. 2829

3312 **Kottlowski, Frank E.; Cooley, Maurice E.; Ruhe, Robert V.** Quaternary geology of the Southwest, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 287–298, illus., 1965.

Quaternary sediments on the Colorado Plateau and in the southern Basin and Range province include glacial materials in the high mountains and plateaus, alluvial and lacustrine sediments in intermontane basins, volcanic accumulations, eolian deposits, paleosols and caliche, and fluvial materials along the rivers. Quaternary history is discussed by areas, southern Arizona and southeastern California, New Mexico, and the Plateau.—E.S.L.

2883 **Krinsley, David; Bé, Allan W. H.** Electron microscopy of internal structures of Foraminifera, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 335–343, illus., 1965.

The present classification of microfossils is based almost entirely upon gross test morphology. This is not always sufficient for a natural classification of such a diverse and variable group as the Foraminifera. Electron microscopy reveals internal structure. Methods of preparing a platinum–palladium–carbon film from an acetate peel, and of viewing and photographing it, are given.—E.S.L.

2777 **Krumbein, W. C.** Sampling in paleontology, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 137–150, illus., table, 1965.

The sampling problem has several aspects. One is search sampling, in which the objective may be to locate fossiliferous horizons. Another is purposive selection, to find certain diagnostic organisms within a horizon. In contrast to these is statistical sampling, which includes an element of randomization. The objective here is to obtain unbiased samples as a basis for statistical inference. Statistical sampling is discussed at more length, with sections on simple random sampling, systematic, stratified, and cluster sampling, channel, composite and grab samples, influence of kinds of samples on statistical models, and vertical and areal sampling.—E.S.L.

2953 **Ku, Teh-Lung; Broecker, Wallace S.** Atlantic deep-sea stratigraphy—Extension of absolute chronology to 320,000 years: Science, v. 151, no. 3709, p. 448–450, illus., 1966.

Thorium–230 measurements on a core of globigerina ooze from the Caribbean Sea substantiate the prediction of Ericson et al., that the paleontological boundary U–V (Sangamon–Illinoian boundary in their scheme) in the Atlantic sediments has an age of close to 320,000 years. As the ages derived by Ericson et al., were based on extrapolations of mean sedimentation rates established by carbon–14 and protactinium–231 dating of the upper sections of this and other cores, this result confirms the assumption that sedimentation rates in the Caribbean Sea have not changed significantly during the past several hundred thousand years. The uranium content of the ocean as indicated by the deposition rate of thorium 230 was no more than 30 percent higher during glacial than during interglacial periods.—Authors' abstract

Ku, Teh-Lung. *See* Bender, M. L. 2957

Kudo, A. M. *See* Shaw, D. M. 3328

3320 **Kugler, H. G.** Sedimentary volcanism [abs.]: Bol. Inf., v. 8, no. 3, p. 81–82, 1965.

2945 **Kullerud, G.; Yoder, H. S., Jr.** Sulfide-silicate reactions and their bearing on ore formation under magmatic, postmagmatic, and metamorphic conditions, *in* Symposium—Problems of postmagmatic ore deposition with special reference to the geochemistry of ore veins, Prague, 1963, V. 2: Prague, Geol. Survey of Czechoslovakia, p. 327–331, illus., 1965.

A pronounced correlation exists between many ores and the rocks in which they occur, and has a definite bearing on the origin of the ores. An understanding of the reactions involved can be obtained through study of the pertinent sulfide-silicate systems. Phase relations in the system Fe–S–O–SiO_2 are discussed and diagrammed. Some experiments using Fe, Mg olivines and sulfur indicate that Mg in silicates does not form sulfides. The role of sulfur in metamorphic processes was indicated by experiments with hedenbergite, almandite, and Fe cordierite. All the reactions point up the very significant role of sulfur.—E.S.L.

2767 **Kummel, Bernhard.** Bibliography on paleontological techniques, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 707–764, 1965.

The citations are arranged under subject and technique, which are listed in a table of contents.—E.S.L.

2768 **Kummel, Bernhard.** Compilation of bibliographies of use to paleontologists and stratigraphers, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 765–832, 1965.

In this selective bibliography individual references are grouped by subject or by country, with cross references.—E.S.L.

2769 **Kummel, Bernhard; Raup, David.** (editors). Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), 852 p., illus., tables, 1965.

This volume, prepared under the auspices of the Paleontological Society, answers the need for an up-to-date, comprehensive sourcebook of field and laboratory techniques. A collection of essays and two bibliographies make up the book. The essays, contributed by more than 80 specialists, describe both classic and modern techniques, and range from fossil-collecting to preparation of illustrations. Most are published here for the first time. There are five parts to the handbook: techniques applicable to the major fossil groups, those having broad applicability, specialized methods used in palynology, bibliography of paleontologic techniques and a compilation of bibliographies of use to paleontologists and stratigraphers.—E.S.L.

3007 **Kupsch, W. O.** Frederic Harrison Edmunds, 1898–1965: Royal Soc. Canada Minutes Proc., 4th ser., v. 3, p. 93–94, portrait, 1965.

2931 **Kutina, Jan; Park, C. F., Jr.; Smirnov, V. I.** On the definition of zoning and on the relation between zoning and paragenesis, *in* Symposium—Problems of postmagmatic ore deposition with special reference to the geochemistry of ore veins, Prague, 1963, V. 2: Prague, Geol. Survey of Czechoslovakia, p. 589–595, 1965.

The authors were appointed at the Prague Symposium to exchange views on the above subject. The compromise statement arrived at is: Zoning in ore deposits is any regular pattern in the distribution of minerals or elements in space; it may be shown in a single ore body, in a mineral district, or in a large region. Although zoning is related to the spatial distribution of elements and minerals, both time and space must be considered in the study of zonal phenomena. The term paragenesis, as used in the United States, is the distribution in time, or the sequence of, minerals or elements. Paragenesis, as widely used in Europe, is an association of minerals having a common origin, for example, a tin–tungsten association.—E.S.L.

3197 **Kvenvolden, Keith A.** Radiocarbon dating of size fractions of a sample of Bahama carbonate sediment: Jour. Sed. Petrology, v. 35, no. 4, p. 874–876, illus., 1965.

Radiocarbon ages of five grain-size fractions range from 1600±130 to 3340±140 years. This variation in age indicates different sources for the materials. The sample probably is composed of carbonate material formed near the depositional site about five miles inland, western Andros Island, Bahamas, as well as material from banks west of Andros Island and from the exposed limestone platform of Andros Island itself.—G.O.B.

3036 **LaFleur, Robert G.** Glacial lake sequences in the eastern Mohawk–northern Hudson region, Trip C, *in* Field trips in the Schenectady area—New York State Geol. Assoc., 37th Ann. Mtg., Union Coll., 1965, Guidebook: New York, City College of City Univ. of New York, Dept. Geology, p. C1–C23, illus., 1965.

The evidence to date indicates a single episode of ice stagnation, with frequent lacustrine accompaniment, through the area north of the Catskills and throughout the easternmost Mohawk and northern Hudson Lowlands. Lakes shown on maps and discussed are: Lake Schoharie, Lake Amsterdam, Lake Albany with the Mohawk delta, and Lake Vermont. Problems in correlation of the later lakes are discussed briefly.—E.S.L.

Laird, W. M. *See* Lemke, R. W. 3244

3088 **Lambert, T. W.** Availability of ground water in parts of Hamlin and Paris Landing quadrangles, Jackson Purchase region, Kentucky: U.S. Geol. Survey Hydrol. Inv. Atlas HA-165, scale 1:24,000, text, 1966.

The most extensive aquifers in the Kentucky parts of the Hamlin and Paris Landing quadrangles are Mississippian limestone, Cretaceous sand, and chert rubble derived from pre-Cretaceous weathering of Mississippian rocks. Minor aquifers are Quaternary deposits, basal Cretaceous gravel, and possibly the upper Tertiary(?) gravel. Quality of water from the chert rubble is excellent for most uses. The map sheet includes sections and a table of water analyses.—M.C.M.

3103 **Lang, William Joseph.** The properties of clay-water systems under pressure [abs.]: Dissert. Abs., v. 26, no. 5, p. 2689, 1965.

3051 **Langbein, Walter B.; Leopold, Luna B.** River meanders—Theory of minimum variance: U.S. Geol. Survey Prof. Paper 422-H, p. H1-H15, illus., tables, 1966.

. . . The planimetric geometry of a meander is that of a random walk whose most frequent form minimizes the sum of the squares of the changes in direction in each successive unit length. Direction angles are then sine functions of channel distance. This yields a meander shape typically present in meandering rivers and has the characteristic that the ratio of meander length to average radius of curvature in the bend is 4.7. Depth, velocity, and slope are shown by field observations to be adjusted so as to decrease the variance of shear and the friction factor in a meander curve over that in an otherwise comparable straight reach of the same river. Since theory and observation indicate meanders achieve the minimum variance postulated, it follows that for channels in which alternating pools and riffles occur, meandering is the most probable form of channel geometry and thus is more stable geometry than a straight or nonmeandering alinement.—Authors' abstract

3028 **Lange, Arthur L.** Cave detection by magnetic surveys: Cave Notes, v. 7, no. 6, p. 41-54, illus., 1965.

. . . Measurements of the vertical field component were made along traverses over six known lava tubes in northern California and their results plotted. The largest anomaly (7259 gammas) was found over Skull Cave (18 m in diameter, with a roof 6 m thick), but its form suggests that it is due primarily to remanent rather than induced magnetization. Anomalies over Danger Cave (up to 3750 gammas) and Tickner Cave (3250 maximum) correspond more satisfactorily to the present induced field. A magnetic contour map of portions of Tickner Cave is presented, demonstrating that the lava tube can be easily recognized as a longitudinal negative trend. The theoretical expression for the vertical component of the magnetic field is derived for the horizontal hollow cylinder and is plotted for comparison with field results.—Author's abstract

2783 **Langenheim, R. L., Jr.** Collecting amber, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 184-188, 1965.

The widespread occurrence of amber in Cretaceous and Tertiary rocks has not received adequate attention from paleontologists and geologists in spite of the well-known occurrences of fossil insects in amber from the Baltic region, Cedar Lake, Manitoba, and Chiapas, Mexico. This paper is offered in the hope that more workers will either collect, or report occurrences of, fossil gums. Varieties of amber are described, and methods given for distinguishing between fossil and modern gums, and synthetics.—E.S.L.

2802 **Langston, Robert L.** Preparing fossils in amber, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 287-293, illus., 1965.

The preparation of fossil specimens in amber requires the various steps of tumbling, cutting, sanding, shaping, and polishing. Except for the tumbling, none of the steps

can be performed by a mass-production method. The equipment and techniques for each step are described.—E.S.L.

3068 **Larocque, G. E.** A sonic unit for the determination of 'in situ' dynamic properties and for the outlining of fracture zones, *in* Symposium on rock mechanics, 6th, Rolla, Mo., 1964, Proc.: Rolla, Mo., Univ. Missouri, p. 358–380, illus., 1964.

A sonic system for probing rock around mine openings is described. Transit time measurements of a few hundred microseconds to many milliseconds can be made with an accuracy of 5 percent. The apparatus is relatively portable and independent of external power requirements; a hammer blow is the source of signal. The basic assumption on which sonic transit velocity is related to fracture zone is stated and some applications are outlined. Field measurements at New Calumet mines in Quebec demonstrate the system's ability to contour large masses. Changes in velocity that can occur with lapse of time and progress of mining were illustrated at the McIntyre mine in Ontario.—E.S.L.

2877 **Laundrum, J. D.** A foundation investigation of Cherokee Cave under Route I–55, City of St. Louis, *in* Highway geology symposium, 15th Ann., 1964, Proc.: Rolla, Missouri Div. Geol. Survey and Water Resources, p. 81–93, illus., 1964.

Cherokee Cave is a large, shallow solution structure, partly collapsed and filled, in the Mississippian St. Louis Limestone, underlying the city of St. Louis under the proposed line of Route I–55 (Ozark Expressway). Recent history and drainage changes in the cave are briefly outlined. Two extensive core drilling surveys were made to determine thickness and soundness of the rook rock and to detect potential collapse areas under and adjacent to the proposed crossing, which will have a 30–ft fill. Remedial measures will include: excavating and refilling the cave entrance corridor, stairwell, and collapsed sink area, with some collapsing of unsound rock; enclosing and grouting unsafe corridors. Present drainage will be maintained through all grouted or filled areas, to prevent flooding of corridors and erosion of new channels.—V.M.J.

3295 **LaValle, Placido D.** Areal variation of karst topography in southcentral Kentucky [abs.]: Dissert. Abs., v. 26, no. 5, p. 2682, 1965.

Laverty, C. L. *See* Radbruch, Dorothy H. 2980

LeBlanc, Rufus J. *See* Bernard, Hugh A. 3313

3244 **Lemke, R. W.; Laird, W. M.; Tipton, M. J.; Lindvall, R. M.** Quaternary geology of northern Great Plains, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 15–27, illus., tables, 1965.

The area discussed includes about 225,000 sq mi of South Dakota, North Dakota, and Montana, most of which was covered by continental glaciers. Six distinct advances are believed to have occurred during Wisconsin time. The classification and correlation of these with the midwestern and alpine glaciations are tabulated. A table giving radiocarbon dates, and maps showing glaciated and unglaciated areas, and major preglacial drainage are included.—E.S.L.

Lennert, Ben J. *See* Radbruch, Dorothy H. 2980

Leonard, A. Byron. *See* Frye, John C. 3299

Leopold, Luna B. *See* Langbein, Walter B. 3051

3132 **Leslie, Robert James.** Ecology and paleoecology of Hudson Bay foraminifera [abs.]: Dissert. Abs., v. 26, no. 4, p. 2135, 1965.

2760 **Lewis, Donald M.; Ogden, Eugene C.** Trapping methods for modern pollen rain studies, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 613–626, illus., 1965.

Contemporary pollen-rain sampling attempts to determine the kinds and amounts of pollen now being deposited. These data aid in interpretation of fossil pollen diagrams. Among natural pollen traps used are bryophytic polsters, upper surfaces of lake sediments, soil surfaces, and ice. Such samples are of doubtful value however. Artificial devices constructed above ground level may have objectionable aerodynamic effects. Requirements for the ideal sampler are listed and microscope slides or adhesive film placed directly on the ground are suggested as most nearly filling them.—E.S.L.

2861 **Lewis, Richard Q., Sr.; Thaden, Robert E.** Geologic map of the Cumberland City quadrangle, southern Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-475, scale 1:24,000, section, text, 1965.

Production of mineral resources in the Cumberland City quadrangle has been limited to small amounts of petroleum, coal, and limestone. Petroleum production from reef limestone in the lower part of the Fort Payne Formation was small and all wells are abandoned; only a few holes have penetrated the Ordovician strata and none was productive. Coal in the shale member of the Lee Formation has been mined on Short Mountain; the quality is poor, the amount small, but it could be mined locally for household use. High-calcium limestone, probably of chemical grade, is available from the Monteagle Limestone; limestone in the Salem and Warsaw Formations and St. Louis Limestone may be useful locally as road gravel. Clay shale and red residual clay are available for possible utilization.—M.C.M.

Lewis, Richard Q., Sr. *See* Thaden, Robert E. 3281

Lindvall, R. M. *See* Lemke, R. W. 3244

2885 **Linsley, R. M.** Collecting molds of fossils, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 189–191, 1965.

Molds contribute little to the study of many groups of organisms whose identification depends on internal structures, and whose anatomy prevents molds of these structures from being formed. Internal molds, steinkerns, can give valuable information on internal shell structures of certain organisms, but usually are of limited value unless found with the external mold. Methods of removing molds from the rocks, or making casts are discussed.—E.S.L.

Lipman, Peter W. *See* Christiansen, Robert L. 2836

Livingstone, D. A. *See* Wright, H. E. 2756

3216 **Loeser, Cornelius James.** The historical geography of Newport Beach, California [abs.]: Dissert. Abs., v. 26, no. 6, p. 3239, 1965.

Long, J. V. P. *See* Muir, I. D. 3326

Long, James A. *See* Dobrin, Milton B. 2843

2989 **Longshore, Judith Clark.** Comparative morphology of orthoclase crystals [abs.]: Houston Geol. Soc. Bull., v. 8, no. 5, p. 16, 1966.

3133 **Lootens, Douglas Joseph.** Structure and petrography of the east side of the Sierrita Mountains, Pima County, Arizona [abs.]: Dissert. Abs., v. 26, no. 4, p. 2135, 1965.

3193 **Loranger, D. M.** Devonian paleoecology of northeastern Alberta: Jour. Sed. Petrology, v. 35, no. 4, p. 818–837, illus., 1965.

The Devonian in the subsurface of northeastern Alberta is divided into 11 formations on the basis of lithology and fauna. Small scale environmental maps are presented for nine of the formations. The maps show subdivisions of neritic, lagoonal, biohermal, and littoral habitats. Much of the discussion in this paper is based on a table that does not accompany the paper.—G.O.B.

2878 **Lounsbury, R. W.; Schuster, R. L.** Petrography applied to the detection of deleterious materials in aggregates, *in* Highway geology symposium, 15th Ann., 1964, Proc.: Rolla, Missouri Div. Geol. Survey and Water Resources, p. 95–115, illus., 1964.

Applications of petrography, in its broader scope, in evaluating concrete aggregates are briefly reviewed, from 1928 to the present. Binocular and polarizing microscopic studies permit identification of potentially deleterious fine-textured materials such as chert, siliceous and dolomitic limestones, and acidic volcanic rocks; aggregates which have reacted chemically in concrete may also be detected and skid resistance may be predicted by thin-section analysis. Differential thermal, X-ray, electron microscope, infrared, and other analyses afford further evaluation data; the combined petrographic analyses may be correlated with chemical and physical tests and the service records of concretes. Some glacial aggregates of the Midwestern States, containing cherts and shales, present special problems; analyses of these are given as examples.—V.M.J.

Lovering, T. G. *See* Young, E. J. 3049

Low, Doris. *See* Todd, Ruth. 2896

3104 **Lumsden, David Norman.** Microfacies of the middle Bird Spring Group (Pennsylvanian–Permian), Arrow Canyon Range, Clark County, Nevada [abs.]: Dissert. Abs., v. 26, no. 5, p. 2689, 1965.

3242 **MacIntyre, Giles Ternan.** The Miacidae (Mammalia Carnivora)—Pt. 1, The systematics of *Ictidopappus* and *Protictis* [abs.]: Dissert. Abs., v. 26, no. 6, p. 3544–3545, 1965.

3260 **MacKallor, Jules A.** Natural gamma aeroradioactivity map of Puerto Rico: U.S. Geol. Survey Geophys. Inv. Map GP-525, scale 1:24,000, text, 1965.

Natural gamma aeroradioactivity of Puerto Rico ranges between 50 and 800 cps, more than three-fourths of the island has a radioactivity of 300 cps or less, and the central part is in general slightly more radioactive than the margins. The central mountainous portion consists mostly of volcanic breccia, flows and tuffaceous siltstone, sandstone, and conglomerate; most common extrusives are andesitic; the extensively folded and faulted rocks are mainly Cretaceous, with some of early Tertiary age. North and south of the central mountainous area are belts of younger geologic units (Tertiary to Recent). The correlation of the 14 geologic units (shown on a generalized geologic inset map) with the aeroradioactivity is summarized; this will be discussed more fully in another report (MacKallor, in press).—M.C.M.

3070 **MacKenzie, W. S.** Upper Devonian stratigraphy, northwest margin of the Southesk reef, eastern Rocky Mountains, Alberta: Canada Geol. Survey Paper 64-19, 94 p., illus., table, 1965.

A summary is presented of Upper Devonian stratigraphy and its relationships in three thrust sheets near the northwest margin of Southesk reef, in the vicinity of Mount MacKenzie, northwest of the Brazeau River. Special reference is made to the complex and highly variable stratigraphy of the transition zone between the reef facies and the surrounding shales. Detailed sections of the various lithologic units are given as an appendix to the report.—*from* Author's abstract

3043 **MacKevett, E. M., Jr.** Preliminary geologic map of the McCarthy B-5 quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-438, scale 1:63,360, 1965.

2908 **MacLean, Brian.** (compiler). Saskatchewan and western Manitoba showing oil and gas fields and oil and gas discoveries—Information to April 1, 1965: Canada Geol. Survey Map 1044A, 8th ed., scale 1:1,267,200, 1965.

2909 **MacLean, Brian.** (compiler). Alberta and northeastern British Columbia showing oil and gas fields and oil and gas discoveries—Information to January 1, 1965: Canada Geol. Survey Map 1039A, 11th ed., scale 1:1,267,200, 1965.

3229 **Malahoff, Alexander.** Magnetic surveys over the Hawaiian Ridge and their geologic implications [abs.]: Dissert. Abs., v. 26, no. 6, p. 3249, 1965.

3122 **Malcolm, Ronald Lee.** Mobile soil organic matter and its interactions with clay minerals and sesquioxides [abs.]: Dissert. Abs., v. 26, no. 4, p. 1918, 1965.

3316 **Malde, Harold E.** Snake River Plain, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 255–263, illus., tables, geol. map, 1965.

The Snake River Plain in southern Idaho is composed of two structural parts, a northwest-trending graben in the west, the bounding faults of which coincide with a line of earthquake epicenters that stretches from Puget Sound to Great Salt Lake, and a structural downwarp in the east. Clastic deposits of the western plain, early and middle Pleistocene, and lava flows of the eastern plain, late Pleistocene and Recent, are described and tabulated. The total section is 1,500 m thick. The lava flows filled a series of canyons as the Snake River was forced southward. Gravel terraces occur along the river, and the Melon Gravel, in gigantic bars, was formed by overflow of Lake Bonneville into the Snake River at Red Rock Pass. A geologic and gravity map is included.—E.S.L.

2886 **Mamay, S. H.** Collecting coal balls, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 192–193, 1965.

Coal balls are abundant in the midcontinent coal fields and rare in the southern Appalachians. They are unknown in the anthracite regions or in any post-Paleozoic coals. However, wherever coal balls occur, the seam is overlain by a marine unit. They may be dug out of the seam if necessary, but are generally collected from waste heaps. Collecting is a haphazard process unless one can identify desirable specimens in the field.—E.S.L.

3155 **Manley, Frederick Harrison, Jr.** Clay mineralogy and clay-mineral facies of the Lower Cretaceous Trinity Group, southern Oklahoma [abs.]: Dissert. Abs., v. 26, no. 3, p. 1593, 1965.

Mann, C. John. *See* Thomas, William A. 2949

2855 **Mapel, W. J.; Read, W. H.; Smith, R. K.** Geologic map and sections of the Doublespring quadrangle, Custer and Lemhi Counties, Idaho: U.S. Geol. Survey Geol. Quad. Map GQ-464, scale 1:62,500, 1965.

3333 **Martin, Paul S.; Mehringer, Peter J., Jr.** Pleistocene pollen analysis and biogeography of the Southwest, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 433–451, illus., tables, 1965.

The southwestern Pleistocene pollen record can be divided into three periods: pre-Wisconsin, Wisconsin, and postglacial. Pre-Wisconsin pollen content of drill cores does not show climatic changes corresponding to multiple glaciations, but stadial-interstadial climatic fluctuation can be recognized in the pollen record of Wisconsin age cores. A change to warm-dry postglacial climates appears to have occurred rather rapidly around 12,000 B.P., with no late-glacial fluctuations evident. Pollen-study areas in the Southwest are shown on a map. Evidence for Altithermal drought present in profiles farther north is not evident in southern Arizona and New Mexico. Two pollen diagrams from Tule Springs, Nevada, and three from southeastern Arizona are included.—E.S.L.

2792 **Martinsson, Anders.** Preparation of individual microfossils on cellulose acetate films, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 247–251, illus., 1965.

The mechanical-chemical methods generally used for disintegration of microfossil samples have some obvious disadvantages. It is often better to pick out single undamaged specimens with a needle. The procedure for doing this, using cellulose acetate glue, is described.—E.S.L.

3016 **Mather, Kirtley F.; Wengerd, Sherman A.** Pleistocene age of the "Eocene" Ridgway till, Colorado: Geol. Soc. America Bull., v. 76, no. 12, p. 1401–1408, illus., 1965.

The "lower or boulder member" of the Ridgway Till at Miller Mesa, Colo., is of Pleistocene age and is overlain by a Pleistocene landslide of San Juan tuff agglomerate. The "upper or pebble member" of Atwood's Ridgway Till is crushed Mancos Shale and is part of that landslide.—A.G.

3081 **Matten, Lawrence C.** Improved technique for preparing iron hydroxide plant petrifactions: Jour. Paleontology, v. 40, no. 1, p. 225–226, illus., 1966.

The quality of polished sections of limonitic plant petrifactions is improved by immersion of the sections in hot oxalic acid. This lightens the color of the matrix and increases the contrast with the dark cell walls.—S.H.M.

3214 **Matten, Lawrence Charles.** Contributions to the Upper Devonian flora of New York [abs.]: Dissert. Abs., v. 26, no. 6, p. 2999–3000, 1965.

3105 **Matthews, Robley Knight.** Genesis of recent lime mud in Southern British Honduras [abs.]: Dissert. Abs., v. 26, no. 5, p. 2689–2690, 1965.

2900 **Matthews, William H., 3d.** How fossils are used: Nature and Sci., v. 3, no. 3, p. 1T, 7T–8T, illus., 1965.

This article, adapted from the textbook, Fossils—An introduction to prehistoric life, 1962, by the author, is meant for school teachers. The use of fossils in dating layers of rock, as clues to climates of the past, as evidence of geographic change, as records of prehistoric life, as evidence of organic evolution, and as economic tools is discussed.—E.S.L.

3023 **Maxwell, Charles H.** Geology of the Phil quadrangle, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ–395, scale 1:24,000, section, text, 1965.

Many holes have been drilled in search of oil in the quadrangle, mostly near faults along the west boundary of the quadrangle. In 1963, 9 wells were producing oil from a zone 30 to 70 feet below the top of the Knox Group (Cambrian and Ordovician) which is generally 1,400 to 1,500 feet below the Chattanooga Shale; another well recently had been abandoned. . . . Gravel deposits are extensive and widespread in the alluvium, especially in stream beds, and are exploited for local use as aggregate and road metal. The gravel is composed mostly of chert fragments and minor amounts of rock fragments.—Author's text

3156 **Maxwell, Dwight Thomas.** Diagenetic–metamorphic trends of layer silicates in the Precambrian Belt series [abs.]: Dissert. Abs., v. 26, no. 3, p. 1593–1594, 1965.

2860 **McAndrews, Harry.** Geologic map of the Bosler quadrangle, Albany County, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ–509, scale 1:24,000, text, 1965.

Although no mineral resources have been exploited in the Bosler quadrangle, there are possibilities for gravel, coal, oil, and gas. Quaternary gravel deposits, similar to those used for road metal near Rock River, cover much of the map area. The Pine Ridge Sandstone Member of the Mesaverde Formation (Late Cretaceous) probably contains coal. Oil and gas producing formations to the west are present as subsurface units in the Bosler quadrangle, and further testing may reveal structural features favorable for accumulation of oil and gas.—M.C.M.

2964 **McAndrews, Harry.** Geologic map of the Lake Ione quadrangle, Albany County, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ–508, scale 1:24,000, section, text, 1966.

Although no mineral resources have been exploited in the Lake Ione quadrangle, interest centers around gravel, coal, oil, and gas. Quaternary gravel deposits cover much of the map area, and the Pine Ridge Sandstone Member of the Mesaverde Formation (Late Cretaceous) probably contains coal but its economic value is not

known. In adjacent areas oil and gas have been produced from several formations which are subsurface units in this quadrangle and local structural features favorable for the accumulation of oil and gas may be present beneath the Quaternary deposits. Fossil localities (fossils identified by W. A. Cobban) are listed.—M.C.M.

McCaslin, W. E. *See* Philbin, P. W. 2969

McClennan, William E., Jr. *See* Hewitt, P. C. 3033

McCloy, James. *See* Dolan, Robert. 2996

3019 **McCulloh, Thane H.** A confirmation by gravity measurements of an underground density profile based on core densities: Geophysics, v. 30, no. 6, p. 1108–1132, illus., tables, 1965.

Accurate laboratory measurements of dry bulk densities of 79 samples of Paleozoic sediments from a borehole near Barberton, Ohio, are the basis of a vertical profile of "natural" density which is within 0.013 g per cm^3 of a profile of in-situ density calculated from gravity variations observed using a LaCoste-Romberg gravimeter in an adjacent vertical mine shaft. Changes in bulk volume during or following the coring process are probably so small that core sample density profiles are reliable even when small numbers of samples of aged cores are used. To be used for in-situ density determinations, gravity measurements must be accurate as well as precise.—D.B.V.

3072 **McCullough, Edgar J., Jr.** Laboratory manual for physical geology: Dubuque, Iowa, Wm. C. Brown Co., 201 p., illus., 1965.

The manual is divided into five sections—mineral descriptions and identification; rock types and identification; maps, types, projections, scales, and so forth; structural geology; and interpretation of topographic maps.—E.S.L.

3230 **McElroy, Marcus Nelson.** Lithologic and stratigraphic relationships between the Reagan Sandstone (Upper Cambrian) and sub-Reagan and supra-Reagan rocks in western Kansas [abs.]: Dissert. Abs., v. 26, no. 6, p. 3249, 1965.

McFarlane, J. F. *See* Franklin, D. W. 2847

McGeary, David F. R. *See* Davis, Richard A., Jr. 3181

3106 **McGinnis, Lyle David.** Crustal movements in northeastern Illinois [abs.]: Dissert. Abs., v. 26, no. 5, p. 2690, 1965.

3000 **McGrain, Preston.** Fuller's earth resources of the Jackson Purchase region, Kentucky: Kentucky Geol. Survey, ser. 10, Bull. 3, 23 p., illus., tables, 1965.

Deposits of clays possessing high absorptive capacity are present in Calloway, Graves, Marshall, and McCracken Counties of western Kentucky. Tests of 10 sample localities taken at widely separated points along the outcrop indicate a large reserve of undeveloped clay with absorptive properties approximating the chemical oil standard. Their location with respect to potential northern markets suggests definite economic possibilities.—Author's abstract

McKenna, M. C. *See* Stucker, G. F. 2799

2784 **McKenna, Malcolm C.** Collecting microvertebrate fossils by washing and screening, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 193–203, illus., 1965.

The most efficient way to collect a large number of small bones and teeth from fossiliferous sites consists in digging up, transporting, and screening large quantities of sediment in water and sorting the dried concentrate. The history of the method is traced and rules to decide which sites to wash are given. The technique itself and construction of the wash boxes are discussed in detail.—E.S.L.

McLennan, Mrs. E. J. *See* Johnston, Robert B. 3009

3191 **McManus, Dean A.** A study of maximum load for small-diameter sieves: Jour. Sed. Petrology, v. 35, no. 4, p. 792–796, illus., 1965.

Efficiency of sieving is indicated by the percentage of finer near-mesh particles that fail to pass through any sieve. The percentage of finer particles retained is a function of the load on the sieve and the length of time of sieving. A graph shows maximum loads for 3-inch diameter sieves at one-fourth and one-half phi intervals. The maximum load is set at five particles per aperture. Sieving time is ten minutes.—R.A.C.

3012 **Megrue, George H.; Kerr, Paul F.** Alteration of sandstone pipes, Laguna, New Mexico: Geol. Soc. America Bull., v. 76, no. 12, p. 1347–1360, 1965.

Near Laguna, New Mexico, numerous, circular, vertical brecciated pipes occur in the Bluff and Summerville Formations. The brecciated pipe material has been bleached white; the potassic and sodic feldspars were altered to illite or sericite and kaolin, and hematite was removed while calcite was introduced from below. Summerville clays altered from predominantly montmorillonite-kaolinite mixtures to mixtures of chlorite, illite (hydromica), mixed layer montmorillonite-illite-chlorite, and kaolinite. During alteration, calcium and potassium were added and iron removed. The pipes apparently originated by collapse following solution; subsequently the brecciated pipe material was altered by ascending hydrothermal solutions.—S.C.C.

Mehringer, Peter J., Jr. *See* Martin, Paul S. 3333

3315 **Meier, Mark F.** Glaciers and climate, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 795–805, illus., 1965.

Glacier variations may reflect variations in climate, but the connection is indirect and complex. Topography and changes in seasonal temperature modify accumulation totals. In the United States solar radiation supplies ablation energy. Changes in the net mass budget cause changes in dynamic response. Moraines and outwash features offer physical evidence of past glacier fluctuations, even though the meaning of some is unclear. The recent history of Nisqually Glacier on Mt. Rainier in Washington is used to illustrate some of the problems involved.—E.S.L.

3209 **Meighan, Clement W.** Pacific Coast archaeology, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 709–720, illus., table, 1965.

Of the 164 radiocarbon dates on Pacific Coast sites, only seven are older than 12,500 yr and five more, from 9,000 to 12,000. The sites and artifacts are described. Three finds of human bones at least several thousand years old are discussed. There is no real archaeological evidence of climatic fluctuations over the past several thousand years. Association of archaeological remains with geologic features has been developed in only a preliminary way.—E.S.L.

3177 **Meland, Nils; Ferm, J. C.; Norrman, J. O.** On the problem of n in weight frequency distributions: Jour. Sed. Petrology, v. 35, no. 4, p. 984–985, 1965.

Conventional statistical treatment of sedimentary particle sieve data is based on total sample weight; it is thereby handicapped by the lack of a clearly defined sample item, and an obscure definition of the total number of sample items, n. Defining the weight of the coarsest particle as a weight unit, and thus, a sample item, yields a redefined n. Sieve data can then be better treated statistically as numerical data.—R.A.C.

Mello, James F. *See* Todd, Ruth, 2896

3174 **Merriam, Richard; Bandy, Orville L.** Source of upper Cenozoic sediments in Colorado Delta region: Jour. Sed. Petrology, v. 35, no. 4, p. 911–916, illus., 1965.

The tectonically active trough containing the Colorado River delta appears to be a northward extension of the Gulf of California. Sedimentary rocks in the trough divide into, (1) Miocene, Pliocene and Pleistocene fanglomerates, conglomerates, breccia, and coarse arkosic sandstone, and (2) Pliocene and Pleistocene clay, silt, and fine sandstone. Coarse sediment was derived locally; fine sediment was transported by the Colorado River, and derived mostly from the Colorado Plateau. Cretaceous Mancos Shale foraminifera are found in the Pleistocene delta sediments.—R.A.C.

3053 **Merrihue, Craig.** Xenon and krypton in the Bruderheim meteorite: Jour. Geophys. Research, v. 71, no. 1, p. 263–313, illus., tables, 1966.

In a series of heating experiments, Xe, radiogenic Xe–129R, and Kr contents, and the Xe and Kr isotopic composition of the Bruderheim meteorite were studied for the separated minerals feldspar, pyroxene, olivine, and troilite and for numerous chondrule fractions. Important differences among the individual minerals and between minerals and chondrules were observed, from which several conclusions are drawn. Differences between chondrules and matrix material are believed to represent differences extant at the time of formation and argue for the presence of two or more types of primordial xenon.—D.B.V.

3107 **Metzger, Charles Frederick.** A study of sorption of cesium by montmorillonite [abs.]: Dissert. Abs., v. 26, no. 5, p. 2690–2691, 1965.

3288 **Middleton, G. V.** Antidune cross-bedding in a large flume: Jour. Sed. Petrology, v. 35, no. 4, p. 922–927, illus., 1965.

Crossbedding and horizontal bedding formed by antidunes in a laboratory flume are described. These structures are characterized by faint lensor wedge-shaped bodies and by entirely low-angle laminae. Although bed forms were destroyed by waning flow, some of the internal structures were preserved so such structures may be expected to occur in ancient rocks.—E.D.M.

2876 **Migliaccio, Ralph R.** Engineering and construction problems in the Valdez district, Alaska, *in* Highway geology symposium, 15th Ann., 1964, Proc.: Rolla, Missouri Div. Geol. Survey and Water Resources, p. 45–79, illus., 1964.

The Valdez highway district comprises about 50,000 sq mi in south-central Alaska, with a total of about 900 miles of existing highway. At present only one highway, the Richardson, traverses the rugged Chugash Mountains, which separate the coast from the interior; a second highway, the Copper River, is now under construction. Maintenance and construction problems related to permafrost, surface icing, and the rugged terrain are discussed. A three-mile section of the Copper River Highway 57 miles north of Cordova must be constructed over the outer margins of a large stagnant ice mass or moraine of the Allen Glacier, where the alignment passes between the glacier and the Copper River.—V.M.J.

Milici, R. C. *See* Greenberg, S. S. 3069

Milici, Robert C. *See* Oder, Charles R. L. 3044

3303 **Miller, Robert Rush.** Quaternary freshwater fishes of North America, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 569–581, illus., table, 1965.

The origin of this freshwater fish scarcely antedates the Cenozoic, except for a few relicts. Fifteen families are represented by 49 genera. Current knowledge of the occurrence and distribution of late Pliocene and Pleistocene fishes is summarized and the significance of representatives from the Great Plains and areas west of the Rocky Mountains is discussed. Lacustrine speciation in Idaho Lake, Idaho, and Bear Lake, Idaho-Utah, relict distributions, and the contribution of Recent and fossil faunas to paleohydrology in the arid West are also treated. The first tabular summary of the known geologic range of living families and genera of American freshwater fishes is given, along with a map showing late Pliocene and Pleistocene collecting sites.—E.S.L.

3050 **Millson, M. F.; Montgomery, D. S.; Brown, S. R.** An investigation of the vanadyl porphyrin compiexes of the Athabasca oil sands: Geochim. et Cosmochim. Acta, v. 30, no. 2, p. 207–221, illus., 1966.

The Athabasca oil sands contain, besides the vanadium porphyrin pigments of normal spectroscopic type common to petroleum deposits, a small amount of an abnormal type. This minor component has been partly separated and concentrated, and its structure has been investigated by decomposition and reformation. It appears to be the vanadyl complex of a porphyrin containing a carbonyl group conjugated with the main chromophore; a similar complex has been prepared from aporphyrin derived from chlorophyll. The oxygenated complex in the oil sand is probably a secondary product formed from the more common petroporphyrins during an oxidative stage in the history of the deposit.—Authors' abstract

Milstead, William W. *See* Auffenberg, Walter. 3337

3205 **Mitchell, J. Murray, Jr.** Theoretical paleoclimatology, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 881–901, illus., tables, 1965.

The central problem of climatic variation and its causes is examined in terms of the basic dynamical theory of world climate. Properties and factors that are indicated by theory to specify present-day climate are identified. Various hypotheses that have been proposed to account for climatic change during the Quaternary are outlined and their potential validity considered. The ultimate cause of the Pleistocene ice age is not clear.—E.S.L.

Montgomery, D. S. *See* Millson, M. F. 3050

2840 **Moore, Frank B.** Geologic map of the Sonora quadrangle, Hardin and Larue Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-492, scale 1:24,000, section, text, 1965.

Oil and gas were discovered during the 1930's in the southwestern part of the Sonora quadrangle; the gas was not exploited but small quantities of oil were produced then and also during the late 1950's. Available records show a productive oil zone about 50 feet below the Late Devonian New Albany Shale. Limestone has been quarried in the Ste. Genevieve Limestone, and there are potential quarry sites in the western half of the quadrangle.—M.C.M.

3157 **Moore, George W.** Origin and chemical composition of evaporite deposits [abs.]: Dissert. Abs., v. 26, no. 3, p. 1594, 1965.

Moore, Richard T. *See* Forrester, James D. 2983

3231 **Morales-Frias, Gustavo Adolfo.** Ecology, distribution and taxonomy of Recent Ostracoda of Laguna de Terminos, Campeche, Mexico [abs.]: Dissert. Abs., v. 26, no. 6, p. 3249, 1965.

2864 **Morris, Robert H.** Geologic map of the Stricklett quadrangle, northeastern Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-394, scale 1:24,000, section, text, 1965.

The most important mineral products of the Stricklett quadrangle are oil and gas from the Bisher Limestone. The even-bedded sandstone in the lower Borden Formation is used locally for various purposes, and gravel from the alluvium along the major streams is utilized for roads. Water suitable for domestic and agricultural purposes is obtained from springs at the base of the Ohio Shale and from shallow wells in the alluvium, the Berea Sandstone, and sandstone in the lower Borden Formation. Landslides along the valleys of Kinniconick and Indian Creeks originate along the Bedford Shale–Ohio Shale contact or where the valley wall has been oversteepened by erosion or excavation.—M.C.M.

2905 **Morrison, Roger B.** Geologic map of the Duncan and Canador Peak quadrangles, Arizona and New Mexico: U.S. Geol. Survey Misc. Geol. Inv. Map I-442, scale 1:48,000, separate text, 1965.

The following rock formations of the Duncan and Canador Peak quadrangles are described: Precambrian granite; Cretaceous Beartooth Quartzite and Colorado Formation; Cretaceous and Tertiary(?) nonmarine shale, sandstone, and conglomerate; Tertiary older andesite, Datil Formation and approximate equivalents, younger basaltic andesite, volcanic conglomerate, older basin fill, and tuff; Tertiary and Quaternary Gila Formation; and Quaternary gravel and alluvial deposits, eolian sand, and playa sediments.—M.C.M.

3301 **Morrison, Roger B.** Quaternary geology of the Great Basin, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 265–285, illus., table, 1965.

The Great Basin consists of about 150 mostly closed desert basins separated by subparallel mountain ranges, outlined by late Cenozoic high angle faults. The intertonguing lacustrine and subaerial units of the nearly complete middle and late Quaternary surpass glacial successions as recorders of climatic changes. Deposits of pre-Wisconsin age include alluvium and lacustrine and glacial deposits. Wisconsin-age deposits are discussed under the individual lakes, especially Bonneville and Lahontan; graphs showing interpretations of their history accompany the discussion.—E.S.L.

2762 **Mosimann, James E.** Statistical methods for the pollen analyst—Multinomial and negative multinomial techniques, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 636–673, 1965.

The purpose of this paper is to place in the hands of the pollen analyst a collection of statistical tools, each of which is illustrated with a numerical example. The methods presented here deal largely with sampling. The choice of a sampling plan should not be arbitrary, because one may be more suited to the study of a given set of parameters than another. After a brief explanation of the models involved, methods are discussed in detail. Models given are for variation of pollen counts within a single level of a profile, for between level variation in the profile, and between-level variance and covariance with large pollen sums.—E.S.L.

3134 **Moussa, Mounir Tawfik.** Geology of the Soldier Summit quadrangle, Utah [abs.]: Dissert. Abs., v. 26, no. 4, p. 2136, 1965.

2961 **Mudge, Melville R.** Geologic map of the Patricks Basin quadrangle, Teton, and Lewis and Clark Counties, Montana: U.S. Geol. Survey Geol. Quad. Map GQ-453, scale 1:24,000, sections, 1966.

3017 **Muilenburg, Garrett A.** Memorial to Oliver Rudolph Grawe (1901–1965): Geol. Soc. America Bull., v. 76, no. 12, p. P183–P186, portrait, 1965.

3326 **Muir, I. D.; Long, J. V. P.** Pyroxene relations in two Hawaiian hypersthene-bearing basalts: Mineralog. Mag., v. 34, no. 268, p. 358–369, illus., tables, 1965.

A preliminary account is given of an optical and electron microprobe investigation into the pyroxene relations of Hawaiian hypersthene bearing lavas. It is shown that the clinopyroxene jackets to the phenocryst hypersthenes consist of strongly zoned augite, not pigeonite as formerly believed; the compositional range of this pyroxene is approximately the same as that of the groundmass augite phase. Groundmass pyroxene relations are complex; in one case two distinct pyroxene phases, augite and pigeonite occur, in the other all compositions lying between augite and pigeonite are encountered.—Authors' abstract

3248 **Muller, Ernest H.** Quaternary geology of New York, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 99–112, illus., tables, 1965.

New York was totally glaciated except for the south shore of Long Island and the Salamanca re-entrant south of Allegheny River. Five glaciations are recorded on Long Island; correlation of the formations is tabulated. Interaction of the upland surface and overriding ice sheet is shown in the rounded summits, finger-lake troughs, glens, abandoned meltwater channels, and the like that characterize the landscape. The Olean, Kent, and Valley Head Substages of the Wisconsin glaciation are described and criteria for their correlation discussed. Deglaciation was accompanied by ponding of proglacial lakes.—E.S.L.

3294 **Mumma, Martin Dale.** Vicksburgian ostracode biostratigraphy of Mississippi and Alabama [abs.]: Dissert. Abs., v. 26, no. 4, p. 2137, 1965.

Munoz, James. *See* Eugster, H. P. 2952

Murata, K. J. *See* Richter, D. H. 3164

Myers, B. N. *See* Broom, M. E. 2992

3108 **Nassichuk, Walter William.** Pennsylvanian ammonoids from Ellesmere Island, Canadian Arctic Archipelago [abs.]: Dissert. Abs., v. 26, no. 5, p. 2691, 1965.

Neff, George E. *See* Richmond, Gerald M. 3300

2780 **Neuman, Robert B.** Collecting in metamorphic rocks, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 159–163, 1965.

The effects of diagenetic, contact, and regional metamorphism on the fossil content of the rocks is discussed. The first step in the search for fossils in metamorphic rocks is to distinguish between bedding and cleavage. The author makes an urgent plea that adequate collections be made. Fossils that come from metamorphic rocks are generally deformed and many specimens may be needed to see all the critical features.—E.S.L.

3037 **New York State Geological Assoc.** Guide book, field trips in the Schenectady area, 37th annual meeting, Union College, Schenectady, Apr. 30–May 2, 1965: New York, City College of City Univ. of New York, Dept. Geology, 111 p., illus., geol. maps, 1965.

Four field trips are given, to the lower Mohawk Valley, southeastern Adirondacks, glacial lake sequences, and to three geologic features—Clifton Park anticline, Geyser Park, and Stark's Knob.—E.S.L.

2894 **New York State Mus.and Sci.Service** The New York State Museum—A short history: Albany, N. Y., State Museum and Sci. Service, 31 p., illus., 1964.

After 20 years of agitation, the New York Geological and Natural History Survey was created in 1836. James Hall began his State service as an assistant geologist and when the museum was organized in 1843, he became its paleontologist. In 1894 he completed the 14 quarto volumes of the *Paleontology of New York*. His work was basic to the museum's continuing reputation as a great center for scientific research. Accomplishments of the Museum and Science Service in other scientific fields are summarized.—M.C.M.

3040 **Newcome, Roy, Jr.** Configuration on the base of the fresh-ground-water section in Mississippi: Mississippi Board Water Commissioners Water Resources Map 65-1, scale about 1 in to 16 mi, 1965.

This map was compiled from electrical logs of oil tests, supplemented by water-well records. . . . In the northeast corner of the State, fresh water occurs to unknown depths in consolidated rocks of Paleozoic age. This map records the base of fresh water only in unconsolidated sediments.—Author's notes

3327 **Nicholls, G. D.** Basalts from the deep ocean floor: Mineralog. Mag., v. 34, no. 268, p. 373–388, illus., tables, 1965.

Basalts dredged from the deep ocean floor, particularly that of the Atlantic, are sometimes rich in aluminum and of similar composition to the Warner high-alumina basalt from California. Both olivine tholeiite and high-alumina type basalt glass have come from the Mid-Atlantic Ridge. It is suggested, tentatively, that under mid-ocean ridges the "basaltic fraction" of the mantle is locally in the form of an amphibole, and that fractional incongruent melting of this amphibole could explain the compositional range encountered in dredged glass samples.—V.S.N.

3290 **Nilsen, Tor H.** Sedimentology of middle Precambrian Animikean quartzites, Florence County, Wisconsin: Jour. Sed. Petrology, v. 35, no. 4, p. 805–817, illus., 1965.

The Pine River quartzite conglomerate and Keys Lake quartzite, low grade metamorphic rocks, and informal members of the Michigamme Slate are highly quartzitic units deposited, presumably, in a eugeosyncline tectonic environment. Sedimentary structure orientations and mineral composition of the rocks of the two units suggest a southeastward sediment movement and derivation from similar sedimentary rock sources to the northwest. Composition and texture suggest deposition in shallow-water marine environment close to source areas. Associated "graywackes" are highly quartzose.—R.A.C.

Nilsson, Harold. *See* Hewitt, P. C. 3033

2903 **Norling, Donald L.; DeBrosse, Theodore A.; Buschman, William J., Jr.** Summary of oil and gas activity in Ohio during 1964: Ohio Div. Geol. Survey Rept. Inv. 56, 139 p., illus., tables, 1965.

Major oil and gas development in Ohio during 1964 occurred in the central portion of the state with intensive activity in exploitation of the Copper Ridge "Trempealeau" Dolomite of Cambrian age. Development of the Silurian Albion Sandstones ("Clinton"), and of the Mississippian Berea Sandstone continued at a steady pace. Total number of new wells drilled was 2,665, of which 202 were gas wells, 717 were oil wells, 187 were combination wells, and 1,559 were failures. Total new footage drilled was 8,128,219 feet, of which 4,426,780 feet was in Morrow County. . . . Annual production was 15,850,000 barrels of oil, valued at 46,669,630 dollars and 37,713,000 thousand cubic feet of natural gas, valued at 8,862,555 dollars. . . .—Authors' abstract

2920 **Norris, D. K.; Stevens, R. D.; Wanless, R. K.** K-Ar age of igneous pebbles in the McDougall-Segur conglomerate, southeastern Canadian Cordillera: Canada Geol. Survey Paper 65-26, 11 p., illus., table, 1965.

Seven igneous pebbles from the McDougall-Segur horizon of the Lower Cretaceous Blairmore Group and Crowsnest Formation of this area yielded K-Ar whole rock ages of 113 to 174 m.y. Palaeontological evidence suggests an Albian age (100-106 m.y.) for this horizon and associated strata; the radiometric ages of the included pebbles are, therefore, compatible with the stratigraphic position of the conglomerate. A series of igneous events throughout the Jurassic and early Lower Cretaceous is indicated. The ages of relatively unweathered pebbles and their association with cherts and quartzites suggestive of Palaeozoic and late Precambrian formations support the idea of derivation from actively uplifting Mesozoic terrane west of their deposition, possibly on the site of the present Purcell and Selkirk Mountains.—*from* Authors' abstract

Norrman, J. O. *See* Meland, Nils, 3177

3232 **Norton, Denis Locklin.** Geological and geochemical investigations of stibnite deposits [abs.]: Dissert. Abs., v. 26, no. 6, p. 3250, 1965.

3027 **Nowlan, G. A.** Use of bathocuproine in the quantitative determination of copper in soils, sediments, and rocks, *in* Geological Survey Research 1965: U.S. Geol. Survey Prof. Paper 525-D, p. D189-D191, table, 1965.

A highly specific and reasonably rapid instrumental method for determiing traces of copper in geologic material is presented. The sample is decomposed with a

mixture of nitric, perchloric, and hydrofluoric acids; estimation of copper is made with bathocuproine (2, 9 dimethyl-4, 7 diphenyl-1, 10 phenanthroline) in an isoamyl alcohol extract. The standard deviation based upon duplicate analyses of 27 samples of stream sediments and rocks is 0.84 ppm copper for the range 5–50 ppm.—Author's abstract

3135 **Oaks, Robert Quincy, Jr.** Post-Miocene stratigraphy and morphology, outer Coastal Plain, southeastern Virginia [abs.]: Dissert. Abs., v. 26, no. 4, p. 2137, 1965.

2830 **Obert, Leonard.** Deformational behavior of model pillars made from salt, trona, and potash ore, *in* Symposium on rock mechanics, 6th, Rolla, Mo., 1964, Proc.: Rolla, Mo., Univ. Missouri, p. 539–560, illus., tables, 1964.

The objectives of this investigation were to develop a model pillar that is realistically related to its prototype in the mine, and to study the strength and deformational behavior of the model pillars. Six models were prepared for creep tests from each of the following: salt from Detroit, Mich., and Lyons, Kans.; trona from Green River, Wyo.; and potash ore from Carlsbad, N. Mex. The creep curves for the model pillars are similar to those obtained by other investigators, and the creep rate in both model and mine pillars varies as some power of the applied pillar load. However, there appears to be a significant difference in the exponent of the pillar stress from model and in situ tests.—E.S.L.

3044 **Oder, Charles R. L.; Milici, Robert C.** Geologic map of the Morristown quadrangle, Tennessee: Tennessee Div. Geology Geol. Map GM 163 NE, scale 1:24,000, section, separate text, 1965.

The text, "Mineral resources summary of the Morristown quadrangle" by G. D. Swingle is cited separately.—M.C.M.

Ogden, Eugene C. *See* Lewis, Donald M. 2760

Oklahoma Geological Survey. *See* Kansas Geological Society. 3076

Oklahoma University School of Geology. *See* Kansas Geological Society. 3076

2820 **Oliver, William A., Jr.** Corals—As illustrated by Paleozoic forms, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 36–40, 1965.

Collecting and sectioning techniques are described. The most important features of fossil corals are internal, but the external features are discussed also. The mode of preservation varies widely and influences collecting and preparation techniques. Modes described are preservation of original structure and form, coarser replacement, and molds and casts.—E.S.L.

3158 **Oman, Carl Henry.** A biostratigraphic study of the Lisbon Formation of Alabama [abs.]: Dissert. Abs., v. 26, no. 3, p. 1594, 1965.

2897 **Ostrom, John H.** The duck billed dinosaur puzzle: Nature and Sci., v. 3, no. 3, p. 10–13, illus., 1965.

In this article, written for school children, Ostrom looks again at the evidence that these dinosaurs lived and fed in water. The growth of the idea is traced from Dr. Leidy's comment that *Hadrosaurus* was most probably amphibious, to the discovery of the hollow crests. Later discoveries have proved that they had good grinding teeth, sometimes fed on pine needles, and had a tail too rigid for swimming. Ostrom believes they lived in lowland areas.—E.S.L.

2976 **Otvos, Ervin G., Jr.** Sedimentary structures and depositional environments, Potsdam Formation, Upper Cambrian: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 159–165, illus., 1966.

The Upper Cambrian Potsdam Formation (orthoquartzitic sandstone and conglomerate) in eastern Ontario, southwestern Quebec, and northern New York State, was deposited during an early Paleozoic transgression over the Precambrian surface of the Canadian shield. Rock types and sedimentary structures indicate three distinct environments: (1) Terrestrial, talus sheet wash fan (quartzite breccia), Frontenac arch, Thousand Islands region; (2) marine and (or) fluvial channel (cross laminated sandstone), Ontario and northern New York; and (3) low-energy, littoral to nearshore (laminated sandstone and some siltstone) Quebec and New York State. Reference outcrops are cited; bibliography is comprehensive.—B.H.K.

3118 **Owen, D. E.** The Cretaceous and Indiana [abs.]: Indiana Acad. Sci. Proc. 1964, v. 74, p. 222, 1965.

Packer, John G. *See* Johnson, Albert W. 3334

3046 **Page, Ben M.** Preliminary geologic map of a part of the Stillwater Range, Churchill County, Nevada: Nevada Bur. Mines Map 28, scale 1:125,000, sections, text, 1965.

Rock units from sedimentary rocks of Paleozoic or Mesozoic age to Plio-Pleistocene basalt and basaltic andesite are described in some detail. The discussion of the Mesozoic folds and thrust faults and Cenozoic structures is keyed to an index map of thrust faults on the map sheet. Mineral deposits are copper, fluorspar, gold, iron, nickel, quicksilver, silver, titanium, and tungsten. A bibliography of 31 items is included.—M.C.M.

2816 **Palmer, Allison R.** Preparation of plates for paleontologic publications, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 456–459, 1965.

All aspects of preparation of fossil illustrations are considered briefly.—E.S.L.

Palmer, Allison R. *See* Rasetti, Franco. 2826

Palowitch, E. R. *See* Deurbrouck, A. W. 3003

Park, C. F., Jr. *See* Kutina, Jan. 2931

3052 **Patton, William W., Jr.** Regional geology of the Kateel River quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-437, scale 1:250,000, 1966.

In addition to the geologic map, the sheet includes an index map of the quadrangle showing location and distribution of field observation points and continuous foot traverses, and a table of invertebrate Mesozoic and Cenozoic fossil collections by R. W. Imlay, J. P. E. Morrison, and D. L. Jones. The geologic map is compiled as part of a long range program to study the Cretaceous sedimentary basins of the Yukon-Koyukuk region.—M.C.M.

Paul, Richard R. *See* Wilson, Roland V. 3271

3038 **Payne, C. Marshall.** Bedrock geologic map, Minneapolis, St. Paul and vicinity: Minnesota Geol. Survey Misc. Map M-1, scale 1:24,000, 1965.

2958 **Pedder, A. E. H.** Some North American species of the Devonian tetracoral *Smithiphyllum*: Palaeontology, v. 8, pt. 4, p. 618–628, illus., 1965.

The tetracoral genus *Smithiphyllum* is emended. It is shown to be closely related to *Tabulophyllum* and consequently is transferred from the Spongophyllidae to the Endophyllidae. Additional material of the type species, *S. imperfectum* (Smith), is described and three new Frasnian species, *S. belanskii* from Iowa, *S. kindlei* from Alberta, and *S. whittakeri* from the Northwest Territories, are erected.—Author's abstract

3109 **Pestana, Harold Richard.** Stromatoporoids of the Coralville Member of the Middle Devonian Cedar Valley Limestone [abs.]: Dissert. Abs., v. 26, no. 5, p. 2691, 1965.

Petty, A. J. *See* Kirby, J. R. 2968

2970 **Petty, A. J.; Vargo, J. L.; Smith, F. C.** Aeromagnetic map of the Denver area, Colorado: U.S. Geol. Survey Geophys. Inv. Map GP–557, scale 1:250,000, 1966.

3331 **Péwé, Troy L.; Hopkins, David M.; Giddings, J. L.** The Quaternary geology and archaeology of Alaska, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 355–374, illus., tables, 1965.

Quaternary deposits mantle virtually all of Alaska, and about 50 percent is covered by glacial materials. Patches of early Pleistocene till are found in most glaciated areas, but during Illinoian, Wisconsin, and Recent times glaciers were more extensive in the south than the north. Wisconsin glaciation consisted of at least two major advances. Eolian deposits of late Pleistocene age cover much of the low-lying parts. Lacustrine deposits are scarce, but about 25 percent of the State is covered by fluvial materials. Marine deposits are confined to a coastal fringe in the north and west. Periglacial deposits occur throughout the State. A few artifact assemblages from western and northern Alaska may be of late Pleistocene age.—E.S.L.

2969 **Philbin, P. W.; McCaslin, W. E.** Aeromagnetic map of the Seminoe Mountains and vicinity, Carbon County, Wyoming: U.S. Geol. Survey Geophys. Inv. Map GP–558, scale 1:48,000, 1966.

2853 **Pierce, William G.** Geologic map of the Deep Lake quadrangle, Park County, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ–478, scale 1:62,500, sections, 1965.

2854 **Pierce, William G.** Geologic map of the Clark quadrangle, Park County, Wyoming: U.S. Geol. Survey Geol. Quad. Map GQ–477, scale 1:62,500, section, 1965.

Pilkey, Orrin H. *See* Giles, Robert T. 3173

3182 **Pirie, R. Gordon.** Sedimentation rates of granule- and pebble-sized clasts, *in* Conf. on Great Lakes Research, 8th, Ann Arbor, 1965, Proc.: Michigan Univ. Great Lakes Research Div. Pub. 13, p. 232–239, illus., 1965.

A theoretical and experimental study of the sedimentation rates of granule- and pebble-sized (1 to 4π) particles in a column of distilled water is discussed as a function of size, density, and shape within the limits of common mineral and lithic clasts.—Author's abstract

2835 **Poole, F. G.** Geologic map of the Frenchman Flat quadrangle, Nye, Lincoln, and Clark Counties, Nevada: U.S. Geol. Survey Geol. Quad. Map GQ–456, scale 1:24,000, section, 1965.

2839 **Poole, F. G.; Elston, D. P.; Carr, W. J.** Geologic map of the Cane Spring quadrangle, Nye County, Nevada: U.S. Geol. Survey Geol. Quad. Map GQ–455, scale 1:24,000, sections, 1965.

3168 **Poole, W. G.** Some sedimentary features of the underthrust Herrera Sands of the Clarke Road area, Barrackpore Oilfield, Trinidad, West Indies [abs.]: Bol. Inf., v. 8, no. 3, p. 85–86, 1965.

3169 **Potter, H. C.** A preliminary map of the geology of the eastern part, Northern Range of Trinidad [abs.]: Bol. Inf., v. 8, no. 3, p. 86, 1965.

3119 **Powell, Richard L.** Development of a karst valley in Monroe County, Indiana [abs.]: Indiana Acad. Sci. Proc. 1964, v. 74, p. 222, 1965.

3110 **Power, Peter Edward.** Climatic significance of some paleosols in western Colorado [abs.]: Dissert. Abs., v. 26, no. 5, p. 2691, 1965.

2764 **Praglowski, J. Radwan.** On the cutting of ultra-thin sections, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 686–696, illus., 1965.

Every stage of the method for cutting ultra-thin sections for pollen studies, using methacrylate, is described in detail.—E.S.L.

2898 **Prance, Ghillean; Klein, Richard M.** The tell-tale dust: Nature and Sci., v. 3, no. 3, p. 14–15, illus., 1965.

The story of fossil pollen, how to sample it, and what it reveals are presented for school children.—E.S.L.

2980 **Radbruch, Dorothy H.; Bonilla, M. G.; Lennert, Ben J.; Blanchard, F. B.; Laverty, C. L.; Cluff, Lloyd S.; Steinbrugge, Karl V.** Tectonic creep in the Hayward fault zone, California: U.S. Geol. Survey Circ. 525, 13 p., illus., 1966.

Brief reports are presented of specific examples of tectonic creep (apparent continuous movement) noted at several places within the Hayward fault zone which trends northwestward near the western front of hills bordering the east side of San Francisco Bay. All deformations are right lateral and range from about 2 inches in the Claremont tunnel to about 8 inches on railroad tracks in the Niles district of Fremont. The creep will continue to damage structures crossing the bands of active movement within the zone.—V.S.N.

2811 **Rasetti, Franco.** Photography of fossils, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 423–430, table, 1965.

This article deals with some general principles of image formation by optical instruments of interest to the fossil photographer, and with practical details about photography by means of ordinary camera lenses. Lenses and cameras, negative materials, mounting and lighting, stereophotography, and immersion in liquids are discussed.—E.S.L.

2826 **Rasetti, Franco; Palmer, Allison R.** Trilobites, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 61–64, 1965.

Techniques and tools for both chemical and mechanical preparation of trilobite fossils are described.—E.S.L.

Raup, David. *See* Kummel, Bernhard, 2769

Ray, D. E. *See* Hibbard, C. W. 3335

Read, W. H. *See* Mapel, W. J. 2855

3251 **Reed, E. C.; Dreeszen, V. H.; Bayne, C. K.; Schultz, C. B.** The Pleistocene in Nebraska and northern Kansas, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 187–202, illus., tables, 1965.

The eastern sixth of the area was glaciated during Nebraskan, Kansan, Illinoian, and Wisconsin time. Classification of the Pleistocene for both states is given. Two glacial drifts of Nebraskan age, and three of Kansan age are correlated with depositional sequences in the periglacial area. Only one till is found in both the Illinoian and Wisconsin, but three formations are in the periglacial section of each. The Pearlette Ash is the best key horizon. Formations are described. Geomorphology and drainage pattern development are discussed and illustrated on a map. An area of stabilized sand hills in north-central Nebraska is reviewed; their origin from the Ogallala and relationsto the Peoria loess are suggested. The

Pleistocene mammals found in terraces in western Nebraska are listed, including some Asiatic forms.—E.S.L.

Reese, Gerd. *See* Johnson, Albert W. 3334

3111 **Renault, Jacques Roland.** The geological conditions of molybdenite deposition as deduced from textural analysis [abs.]: Dissert. Abs., v. 26, no. 5, p. 2692, 1965.

3136 **Riccio, Joseph Frank.** Recent and Upper Pliocene sediments of the southwestern portion of Los Angeles County, California [abs.]: Dissert. Abs., v. 26, no. 4, p. 2138–2139, 1965.

3001 **Richards, Horace G.; Fairbridge, Rhodes W.** Annotated bibliography of Quaternary shorelines (1945–1964)—Prepared for 7th Internat. Cong. INQUA, 1965: Acad. Nat. Sci. Philadelphia Spec. Pub. 6, 280 p., 1965.

Citations of some 2,400 articles are grouped geographically; all have English abstracts. Areas pertinent to North American geology are: Atlantic, Gulf, and Pacific coast sections of the United States; eastern, Arctic, and Pacific coast regions of Canada; Mexico; Alaska; West Indies and Central America (including Bermuda and the Bahamas); Greenland; and Oceania (including Hawaii). Some general papers are listed, and there is an author index.—M.C.M.

3250 **Richards, Horace G.; Judson, Sheldon.** The Atlantic Coastal Plain and the Appalachian Highlands in the Quaternary, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 129–136, illus., tables, 1965.

No completely satisfactory correlation between the marine Pleistocene deposits of the Coastal Plain and glacial chronology has been made. There is good evidence that the lowest deposits date from the Sangamon. Deposits of glacial age are not to be expected along the coast from New Jersey southward as the sea level was too low. Periglacial features preserved in surficial deposits south of the Wisconsin ice margin, possibly as far south as Maryland and Kentucky, are discussed.—E.S.L.

2955 **Richardson, E. S., Jr.** Wormlike fossil from the Pennsylvanian of Illinois: Science, v. 151, no. 3706, p. 75–76, illus., 1966.

Tullimonstrum gregarium was a common, possibly marine, invertebrate in certain shallow, offshore waters of northern Illinois during the Middle Pennsylvanian. It had a flexible proboscus armed with teeth; a mobile tail; and a curious transverse bar behind the head, bearing a pair of round, external organs.—Author's abstract

Richardson, E. V. *See* Chang, F. M. 2867

3252 **Richmond, Gerald M.** Glaciation of the Rocky Mountains, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 217–230, illus., tables, 1965.

Glaciers were developed in most of the Rocky Mountain ranges as far south as latitude 33°22′. Early glaciers appear to have been broad shallow lobate masses, but after canyon erosion, subsequent glaciers formed thick tongues in the valleys. Five distinct glaciations are recognized: Washakie Point, Cedar Ridge, Sacagawea Ridge, Bull Lake, and Pinedale. Tills of the three oldest glaciations are deeply weathered and separated by major interglaciations. The two youngest Pleistocene glaciations each include several advances. Neoglaciation was confined to cirques. Pleistocene snowlines are discussed, and correlation charts of the glaciations are included.—E.S.L.

3300 **Richmond, Gerald M.; Fryxell, Roald; Neff, George E.; Weis, Paul L.** The Cordilleran Ice Sheet of the Northern Rocky Mountains, and related Quaternary history of the Columbia Plateau, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 231–242, illus., table, 1965.

The ice sheet covered most of the Rocky Mountains west of the continental divide during each major glacial advance and extended onto the Columbia Plateau west

of Grand Coulee. Glaciations of the 10 lobes are discussed, a map shows the ice sheet and related features, and the deposits and events are correlated in a chart. The ice sheet blocked the Clark Fork River at least five times forming Glacial Lake Missoula, and the Columbia River three times forming Glacial Lake Columbia. During Bull Lake glaciation it also blocked the Spokane River at two points forming Glacial Lakes Coeur d'Alene and Spokane. The ice dam impounding Glacial Lake Missoula collapsed three or more times, releasing catastrophic floods across the Plateau. Seven different Pleistocene loesses and a Recent loess are recognized on the Plateau.—E.S.L.

2917 **Richter, D. H.** Geochemical investigation of the Slana district, southcentral Alaska, 1963 and 1964: Alaska Div. Mines and Minerals Geochem. Rept. 2, 14 p., illus., table, 1965.

In this area of the eastern Alaska Range, a series of Permian(?) volcanics and interbedded sediments are intruded by igneous stocks, dikes, and sills ranging in composition from quartz monzonite to gabbro. Tests of more than 500 stream sediment samples showed anomalous concentrations of heavy metals, most of them on streams draining the border zone of the quartz monzonite pluton and the diorite–quartz diorite intrusives, none draining the core of the pluton. Zinc and lead are the principal enriched metals related to the border zone and copper to the core. Two areas warrant further investigation—one near Long Lake and the other southeast of Flat Lake.—G.D.C.

3164 **Richter, D. H.; Murata, K. J.** Petrography of the lavas of the 1959–60 eruption of Kilauea volcano, Hawaii: U.S. Geol. Survey Prof. Paper 537-D, p. D1–D12, illus., table, 1966.

Petrographic studies of a suite of lava samples, collected throughout the 1959–60 eruption of Kilauea volcano, have yielded a detailed picture of the changes in lava mineralogy with respect to time, temperature, and bulk chemistry. Results are explained in terms of fractional crystallization of basaltic magmas and of the mixing of two magmas of different vintage. By correlating the petrographic data on the lavas with temperatures measured during their eruption, schemes of crystallization of the 1959 summit and the 1960 flank magmas have been derived. The observed range of temperature over which a mineral separated from the magma is given. The liquidus and indicated temperatures of complete crystallization of the magmas, derived from data of the eruptions, are appreciably lower than those determined in quenching experiments.—*from* Authors' abstract

3057 **Rife, Byron.** Guy E. Green—1896–1965: South Texas Geol. Soc. Bull., v. 6, no. 3, p. 4–5, portrait, 1966.

2809 **Rigby, J. Keith; Clark, David L.** Casting and molding, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 389–411, illus., table, 1965.

This paper is intended for those who have not prepared molds or casts, and for those who wish to experiment with different techniques. Some hints are given for general preparation of specimens for molding, but the main body of the paper is devoted to materials commonly used in molding and casting. Widely used and simple techniques as well as more complex methods are discussed. Impregnation and embedding techniques are described briefly.—E.S.L.

3212 **Ritchie, William A.** The earliest occupants—Paleo Indian hunters (c. 7000 B.C.)—Chap.] 1 *in* The archaeology of New York State: Garden City, N. Y., Natural History Press, p. 1–30, illus., 1965.

The evidence of early man in the northeastern United States consists chiefly of fluted points and several camp sites. The principal item of identification is the Clovis point, since no skeletal remains have yet been found. The distribution of the artifacts, and the materials of which they are made, make it possible to trace the movements of the hunters who probably can be confined to the upper third of the Wisconsin age. The events of this period and the artifacts connected with them are summarized. Later in the postglacial, the Clovis tradition is succeeded by Plano

points. Artifacts and sites are described and illustrated. Maps show discoveries of mammals in the State and distribution of fluted points in the Northeast in relation to Port Huron moraines, Lake Iroquois, and the Champlain Sea.—E.S.L.

2797 **Robison, Richard A.** Use of the vibro-tool for mechanical preparation of fossils, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 267-270, illus., 1965.

The Burgess Vibro-tool is illustrated and described. Its special adaptations and techniques for its use are discussed.—E.S.L.

3021 **Rode, K.** Feldgeologische Notizen über die Becken von Baja Verapaz, Guatemala [with English, French, Spanish, and Russian abs.]: Geol. Rundschau, v. 54, no. 2, p. 650-667, illus., 1965.

The basins of Baja Verapaz, Guatemala, belong to an old zone of depression to be traced as far as the Puerto Rico Trough. However, their present pattern is not controlled by tectonics. The filling, containing both fresh and redeposited pumice, as well as the morphology, makes possible regional considerations.—*from* Author's abstract

2938 **Rode, K. P.** On the nature of the Central American orogeny, *in* Dr. D. N. Wadia Commemorative Volume: Calcutta, India, Mining, Geol. and Metall. Inst. India, p. 33-48, illus., 1965.

Diverse theories have been proposed for this zigzag isthmian linkage and system of island arcs, separated by seas and ocean depths, between North and South America. Rode presents data on the geographic distribution of geomorphological features, and suggests that the rock formations, deposited in a common yet expanding mediterranean geosyncline, under repeated volcanism have suffered stages of sheeting and lateral movements. The resulting system of island arcs, showing radial relationships, remain on the Atlantic side in between the westward drifting continents whose pivotal motion (clockwise and anticlockwise) narrows their linkage on the Pacific side.—G.D.C.

2948 **Roedder, Edwin.** Evidence from fluid inclusions as to the nature of the ore forming fluids, *in* Symposium—Problems of postmagmatic ore deposition with special reference to the geochemistry of ore veins, Prague, 1963, V. 2: Prague, Geol. Survey of Czechoslovakia, p. 375-384, illus., tables, 1965; discussion, ibid., p. 453, 458-459, 1965.

Fluid inclusions in ore minerals and coprecipitated gangue minerals contain about the only known samples of ore fluids. Not all such inclusions are valid samples however, as it is necessary to know first how the inclusion was formed and what fluid it trapped. Some of the criteria for determining the origin of inclusions are illustrated in a series of photomicrographs of doubly-polished plates of ore and gangue minerals. Studies of these are discussed and some results are shown in tables and diagrams.—E.S.L.

2798 **Roepke, Harlan H.** Rock trimmers, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 270-272, 1965.

The two types of rock trimmers in widespread use today differ principally in the mechanism by which pressure is exerted. Those that exert pressure by means of a screw are probably the most common. The more recently available hydraulic jack operated trimmers have proved advantageous in dealing with especially tough rock. Limiting factors in both types are listed. Suggested procedures for their best use are given.—E.S.L.

2806 **Rolfe, W. D. Ian.** Uses of ultraviolet rays, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 350-360, illus., 1965.

Ultraviolet rays can be used either to improve photographic resolution with small specimens, or in fluorescence studies. Principles and methods of both are discussed, and some of the uses described and illustrated with photographs.—E.S.L.

2884 **Rolfe, W. D. Ian.** Uses of infrared rays, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 344–350, illus., 1965.

Many fossils, that are of the same color as the matrix or are dark or even opaque, when examined by infrared may show contrast with their matrix or may become transparent enough so that internal structure may be seen. The best known use is probably in paleobotany. The equipment (image converter, source of radiation, and sensitized film and plates) is discussed. Suggestions are given for using a camera with infrared light.—E.S.L.

Ross, Charles A. *See* Ross, June R. P. Phillips. 2821

3306 **Ross, Herbert H.** Pleistocene events and insects, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 583–596, illus., 1965.

Climatic changes associated with Pleistocene events set the stage for insect dispersals that resulted in an increase in number of species or produced isolated populations that have the potential to evolve into new species. Four dispersals are described, intraregional in the East, intraregional between mountain ranges in the West, interregional-transcontinental between East and West, and intercontinental. The importance of the belt of habitats extending from the Appalachians to the Ozarks is emphasized. Distribution maps of several species are included.—E.S.L.

2821 **Ross, June R. P. Phillips; Ross, Charles A.** Bryozoans, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 40–44, illus., 1965.

Paleozoic Bryozoa, except Ctenostomata, are identified by thin-section study, whereas Paleozoic Ctenostomata and Mesozoic and Tertiary Cyclostomata and Cheilostomata are generally studied by means of their external features, with supplementary thin sections. Sectioning techniques are given.—E.S.L.

2994 **Ross, Malcolm; Takeda, Hiroshi; Wones, David R.** Mica polytypes—Systematic description and identification: Science, v. 151, no. 3707, p. 191–193, illus., tables, 1966.

X-ray studies of mica specimens from a variety of geological localities show that biotite and certain lithium-rich mica samples are composed of a mixture of different polytypes. Many of the biotite structures are new complex polytypes not before reported. A new method of designating mica polytypes is proposed. Techniques are described for the systematic generation of all the possible layer-stacking sequences of mica polytypes and for the verification of the stacking sequences in newly discovered forms.—Authors' abstract

Rouse, John T. *See* Behre, Charles H., Jr. 2913

3054 **Row, Ronald V.** Evidence of long-period acoustic-gravity waves launched into the F region by the Alaskan earthquake of March 28, 1964: Jour. Geophys. Research, v. 71, no. 1, p. 343–345, illus., 1966.

The data on ionospheric disturbances following the Alaskan earthquake of 1964 published by Leonard and Barnes (1965) and Davies and Baker (1965) are shown to be mutually compatible. It is suggested that the large long-period disturbance seen on Doppler records at Boulder and vertical sounder ionograms at Boulder and other locations are a manifestation of long-period ducted acoustic-gravity waves launched into the ionosphere near the epicenter.—D.B.V.

Ruhe, R. V. *See* Wright, H. E., Jr. 3210

3208 **Ruhe, Robert V.** Quaternary paleopedology, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 755–764, illus., table, 1965.

Relict, buried, and exhumed paleosols are recognized by properties used to identify analogous modern soils. Paleosols are the upper part of the weathering profile and change laterally. They may be analyzed on the basis of their physical, mineralogical, and chemical properties, except where secondary enrichment has occurred. Paleosols are used principally for stratigraphic purposes and for environmental interpretations. The problem of gumbotil of the Midwest is discussed.—E.S.L.

Ruhe, Robert V. *See* Kottlowski, Frank E. 3312

Rukavina, N. A. *See* Sutton, R. G. 3183

3233 **Rukavina, Norman Andrew.** Particle orientation in turbidites—Theory and experiment [abs.]: Dissert. Abs., v. 26, no. 6, p. 3250, 1965.

3234 **Runnells, Donald DeMar.** The copper deposits of Ruby Creek, Cosmos Hills, Alaska [abs.]: Dissert. Abs., v. 26, no. 6, p. 3251, 1965.

3137 **Russell, Ernest Everett.** Stratigraphy of the outcropping Cretaceous beds below the McNairy Sand in Tennessee [abs.]: Dissert. Abs., v. 26, no. 4, p. 2139, 1965.

3011 **Russell, Loris S.** Frank Harris McLearn, 1885–1964: Royal Soc. Canada Minutes Proc., 4th ser., v. 3, p. 135–139, portrait, 1965.

2790 **Sachs, K. N., Jr.** Preparing paired thin sections from single larger Foraminifera, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 238–241, illus., 1965.

Specific identification of certain larger Foraminifera is based on the appearance of internal features. In order to get equatorial and vertical thin sections of the same specimen, it can be ground down to the equatorial layer on one side only, studied and photographed, and then a vertical thin section made of the remaining half. The author has developed an apparatus which makes it possible to obtain thin sections in both planes. The sawing device and techniques for using it are described.—E.S.L.

3172 **Sahu, Basanta K.** Transformation of arithmetic and phi size-distribution moments: Jour. Sed. Petrology, v. 35, no. 4, p. 969–972, 1965.

Arithmetic moments may be transformed to phi moments or vice versa, for number frequencies or weight percentages. Statistical measures based on phi distribution moments or graphic measures may be obtained mathematically. Calculations for thin-section data include corrections for random sectioning of grains.—R.A.C.

3200 **Sahu, Basanta K.** Transformation of weight- and number-frequencies for phi-normal size distributions: Jour. Sed. Petrology, v. 35, no. 4, p. 973–975, 1965.

Weight and number frequencies for phi-normal size distributions may be transformed mathematically from one to the other but the results are only approximate when the distributions are not exactly log-normal.—R.A.C.

3170 **Salvador, A.; Stainforth, R. M.** Clues in Venezuela to geologic problems in Trinidad, and vice versa [abs.]: Bol. Inf., v. 8, no. 3, p. 88, 1965.

2761 **Samuelsson, K. E.** Photomicrography of recent and fossilized pollen, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 626–636, illus., tables, 1965.

For photomicrography of pollen, a relatively strong light source should be used, and the opening of the lamp diaphragm should be the same as that of the objective aperture. Focus at the largest diaphragm opening, and use the opening that gives the best resolution. Pollen grain color should be taken into account and a suitable

filter and appropriate film used. Exposure time should be determined carefully and the film developed always at the same temperature. An exposure table, and tables of filter and film choice are included. Plates show detailed photography of pollen.—E.S.L.

2942 **Sanders, Robert B.** A new species of *Septemchiton*: Oklahoma Acad. Sci. Proc. 1964, v. 45, p. 94–98, illus., 1965.

A reexamination of the problematical Ordovician microfossils described as tegmates has revealed their origin as the disarticulated plates of a primitive chiton. The plates were collected from the Ordovician Maquoketa Shale in the Graf area, Iowa. The name *Septemchiton iowensis* is proposed for the hypothetically reconstructed organism. The plates are figured and the plates and organism described. The taxonomic affinity of *S. iowensis* is discussed briefly.—E.S.L.

3278 **Saunders, J. B.; Kennedy, J. E.** Sedimentology of a section in the upper Morne L'Enfer Formation, Guapo Bay, Trinidad [abs.]: Bol. Inf., v. 8, no. 3, p. 88–89, 1965.

2918 **Saunders, Robert H.** A geochemical investigation in the Richardson area, Big Delta quadrangle, Alaska: Alaska Div. Mines and Minerals Geochem. Rept. 3, 13 p., illus., tables, 1965.

The Richardson area, on the north side of the Tanana River valley in Interior Alaska, has been mined for gold which is no longer productive. The unusually low fineness of the gold indicates accompanying base-metal mineralization. Sixty-six sediment samples from four south-flowing streams were analyzed for trace amounts of copper, lead, zinc, and molybdenum. In most panning failed to recover any concentrates, but in three cases where they were recovered, mineral identifications were confirmed by laboratory analysis which also found anomalous amounts of metal in other samples not detected by the field test. The anomaly indicated by samples from five tributaries to the north fork of Banner Creek appears to warrant further investigation for lead and copper and zinc.—G.D.C.

Savage, D. E. *See* Hibbard, C. W. 3335

2924 **Sawkins, F. J.; Huebner, J. S.** Postmagmatic ore deposition in the light of fluid inclusions studies, Providencia mine, Zacatecas, Mexico, *in* Symposium—Problems of postmagmatic ore deposition with special reference to the geochemistry of ore veins, Prague, 1963, V. 2: Prague, Geol. Survey of Czechoslovakia, p. 424–428, illus., 1965.

In the Providencia mining area, pipe-like bodies of silver-lead-zinc ore occur in steeply dipping limestones close to a quartz monzonite stock. A lime-silicate contact zone has been formed in the limestones. Structural control and paragenesis are discussed, and a summary of the temperature data from study of inclusions is included in a paragenetic diagram.—E.S.L.

2925 **Sawkins, F. J.** Discussion [of "Evidence from fluid inclusions as to the nature of the ore-forming fluids," by E. Roedder, 1965], *in* Symposium—Problems of postmagmatic ore deposition with special reference to the geochemistry of ore veins, Prague, 1963, V. 2: Prague, Geol. Survey of Czechoslovakia, p. 447–451, illus., 1965.

Sawkins presents some results of fluid inclusion studies made on the Providencia lead-zinc deposits, Zacatecas, Mexico. A generalized paragenetic diagram is shown. The later ore is vuggy, and it is on this material that the inclusion studies have been concentrated. Photographs show zoning of sphalerite crystals, and it is within the framework of the zoning that the temperature and salinity data have been plotted.—E.S.L.

2890 **Schaeffer, Bobb.** Fishes, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 110–118, 1965.

Fossil fishes occur most commonly in shales, perhaps less commonly in limestones, and most rarely in sandstones. Complete specimens or skulls, with little distortion, represent the rarest sort of preservation, and occur most commonly in concretions. Collecting techniques are given in connection with the type of rock. Preparation and study methods are discussed in detail.—E.S.L.

2833 **Schafer, J. P.** Surficial geologic map of the Watch Hill quadrangle, Rhode Island–Connecticut: U.S. Geol. Survey Geol. Quad. Map GQ-410, scale 1:24,000, 1965.

3249 **Schafer, J. P.; Hartshorn, J. H.** The Quaternary of New England, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 113–128, illus., tables, 1965.

Several Pleistocene ice advances crossed New England to or beyond the present south coast. The most comprehensive stratigraphic sections are those of Martha's Vineyard, with seven drifts, and the Boston basin, with four. Some of the older drifts are of pre-Sangamon age. The disappearance of the last ice sheet was by stagnation-zone retreat; large glacial lakes are inferred from lacustrine deposits. Late-glacial marine submergence occurred in the Champlain lowland and northern coast. Frost and eolian features record climatic conditions different from those of the present. Postglacial changes have been minor compared to the effects of glaciation. A correlation chart of the Pleistocene in southern New England and a map showing end moraines are included.—E.S.L.

2804 **Schopf, James M.** A method for obtaining small acid-resistant fossils from ordinary solution residues, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 301–304, illus., 1965.

This paper presents a practical preparation schedule that will permit the recovery of acid-resistant microfossils in the course of applying any of the various rock-solution procedures. A decantation sequence for the solution residues, a fine sludge, is given, and suggestions made for palynological study.—E.S.L.

3031 **Schopf, Thomas Joseph Morton.** Conodonts of the Trenton Group (Ordovician) in New York, southern Ontario, and Quebec [abs.]: Dissert. Abs., v. 25, no. 12, pt. 1, p. 7206, 1965.

2899 **Schuberth, Christopher J.** Exploring for fossils: Nature and Sci., v. 3, no. 3, p. 6–7, illus., 1965.

Instructions on fossil collecting for the elementary-age student are given as the Science Workshop section of this issue.—E.S.L.

Schultz, C. B. *See* Reed, E. C. 3251

Schumann, H. H. *See* Kister, L. R. 3087

3203 **Schumm, S. A.** Quaternary paleohydrology, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 783–794, illus., tables, 1965.

The modern relations that exist among the climatic and hydrologic variables are used to predict the hydrologic effects of Quaternary climatic changes. A decrease in temperature and an increase in precipitation of the magnitudes associated with Pleistocene glaciation would substantially increase runoff and decrease the sediment concentration of the runoff. Sediment yields, however, may either increase or decrease depending on the climate before the change. The effect of a climatic change on river activity is complicated by the effects of glacial activity and baselevel change.—E.S.L.

Schuster, R. L. *See* Lounsbury, R. W. 2878

2951 **Schwartz, Maurice L.** Fluorescent tracer—Transport in distance and depth in beach sands: Science, v. 151, no. 3711, p. 701–702, illus., 1966.

Foreshore tidal-cycle transport of sediment along a beach profile can be traced in distance and depth by the use of fluorescent pigments. Sediment cores are obtained from locations on the profile, dyed in horizontal segments, and returned to their original positions in the beach. Analyses of flood- and ebb-tide samples of sediment reveal the pattern of littoral zone sedimentation.—Author's abstract

3253 **Scott, Glenn R.** Nonglacial Quaternary geology of the southern and middle Rocky Mountains, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 243–254, illus., tables, 1965.

Nonglacial Quaternary deposits discussed in this report are on the Colorado Piedmont and in broad basins between high ranges. These surficial deposits are the result of repetitive physical processes controlled by cyclic changes in climate. The Piedmont contains nine formations of alluvium, four were deposited as pediments, and five as terrace fills when streams cut downward more than sideward. The intermontane basins also contain a sequence of early pediments and late fill terraces. The different basins are discussed and terraces and pediments tabulated. Glacial and nonglacial sequences are correlated with the nonglacial sequence of Nebraska.—E.S.L.

2915 **Scott, K. R.; Hayes, W. E.** A summation—The Cretaceous beds of the outcrop and their subsurface equivalents, *in* Cretaceous of southwest Arkansas—Shreveport Geol. Soc., 1965 Field Trip Guidebook: Shreveport, La., Shreveport Geol. Soc., p. 32–35, illus., 1965.

Approximately 1,100 feet of Lower Cretaceous beds are exposed in south Arkansas. In the subsurface of the extreme southwestern part these beds reach a thickness of approximately 5,000 feet, and a thickness of 7,000 feet has been penetrated in Louisiana. The composite thickness of the Upper Cretaceous outcrops is about 1,800 feet in this area, and in the subsurface, thicknesses of more than 2,000 feet have been penetrated.—E.S.L.

3112 **Scott, Robert Blackburn, 3d.** The Tertiary geology and ignimbrite petrology of the Grant Range, east central Nevada [abs.]: Dissert. Abs., v. 26, no. 5, p. 2692, 1965.

3056 **Sebring, Louie, Jr.** Essential abilities of the oil-finding geologist: South Texas Geol. Soc. Bull., v. 6, no. 2, p. 4–11, 1966.

The primary essential abilities of an oil-finding geologist are to locate and recognize a significant anomaly, and to get this anomaly tested. Desirable traits and characteristics to achieve these two goals are summarized, and suggestions are made for management and investor assistance.—M.C.M.

o3336 **Selander, Robert K.** Avian speciation in the Quaternary, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 527–542, illus., tables, 1965.

Although the Pleistocene in North America was a period of reduction in total numbers of species and adaptive types of birds, it was also a time of active speciation. The theory of a Pliocene origin for most or all modern bird species is not supported by the fossil record. Patterns of distribution and secondary contact of modern populations provide strong circumstantial evidence that glaciation and other events of the Quaternary profoundly influenced avian speciation. The speciation process is characterized by great variation in rate, depending importantly upon factors of population size, isolation, and rate and degree of environmental change.—Author's abstract

2910 **Sellman, Paul V.; Brown, Jerry.** Coring of frozen ground, Barrow, Alaska, spring 1964: U.S. Army Materiel Command, Cold Regions Research and Eng. Lab. Spec. Rept. 81, 8 p., illus., table, 1965.

The frozen ground near Barrow was cored to obtain more stratigraphic information on the late Pleistocene Gubik Formation, to ascertain the boundary between reworked and undisturbed sediments, and to ascertain moisture-depth relationships

on geomorphic units. Techniques and equipment, with a section on sample processing, are described. A table gives the coring record, and some preliminary observations are included. It appears that the sediments can be correlated, and that below 7 m primary structures are preserved.—E.S.L.

3235 **Semken, Holmes Alford, Jr.** Stratigraphy and paleontology of the McPherson *Equus* beds (Sandahl local fauna), McPherson County, Kansas [abs.]: Dissert. Abs., v. 26, no. 6, p. 3251–3252, 1965.

SEPM, Pacific Sec. *See* Coast Geological Society. 3259

2841 **Seriff, A. J.; Velzeboer, C. J.; Haase, R. J.** Possible P-wave observations in short-period seismic noise: Geophysics, v. 30, no. 6, p. 1187–1190, illus., 1965.

A program of seismic noise measurements (frequency range 0.2–5.0 cps) in deep boreholes has been under way for the past two years. Preliminary results are consistent with the hypothesis that below about 1.0 cps the noise consists of an energy-equipartition mixture of Rayleigh and Love modes and a P-wave component with vertical motion energy at the surface almost equal to that of the sum of the trapped modes. Observed ratios of surface horizontal-to-vertical component motions are also compatible with this hypothesis, as are the amplitude-depth relationships. However, nearly equipartition mixtures of the theoretically computed trapped modes can be found which simulate many of the time averaged effects of P-waves remarkably well, so that unequivocal conclusions are difficult to draw.—D.B.V.

3328 **Shaw, D. M.; Kudo, A. M.** A test of the discriminant function in the amphibolite problem: Mineralog. Mag., v. 34, no. 268, p. 423–435, tables, 1965.

The application of discriminant function analysis to resolution of the problem of amphibolite classification is discussed. The method gives the coefficients of the best linear combinations of the n-variables to discriminate between two or more clusters of points, together with a measure of their degree of overlap. The approach has been applied in a limited area where known ortho- and para-amphibolites occur, Chandos township in Grenville province of southeastern Ontario. Samples are described and analyses and computations are given; results of classification of several rocks by discriminant function are tabulated. Problems in interpretation are discussed.—V.S.N.

3013 **Shaw, Daniel R.** Strike-slip control of Basin-Range structure indicated by historical faults in western Nevada: Geol. Soc. America Bull., v. 76, no. 12, p. 1361–1378, illus., 1965.

Surface faults associated with seven major earthquakes in the last 60 years form a coherent arcuate linear zone called the Churchill arc. A progressive change from dip-slip normal faulting at the north end of the arc to dominantly right-lateral strike-slip faulting at the south end suggests a relationship to the Walker Lane at the south end. The Walker Lane is a major northwest-trending structural zone along which significant right-lateral strike-slip movement has occurred. The general northerly orientation of basin-range mountains may be related to a structural grain established prior to the development of the block-faulted mountains.—J.P.A.

3091 **Shaw, Don Wayne.** Mutual adsorption of clay minerals and colloidal hydrous chromium oxide—An electron microscopy investigation [abs.]: Dissert. Abs., v. 26, no. 5, p. 2506–2507, 1965.

2943 **Shead, A. C.** Rational mineral analyses, computed from complete empirical chemical analysis in the detection and correction of errors in quantitative analytical geochemistry: Oklahoma Acad. Sci. Proc. 1964, v. 45, p. 99–107, tables, 1965.

Washington's method is applied to detection of errors in quantitative geochemical analysis. It consists of converting an analysis expressed in terms of hypothetical combinations to the corresponding expression in terms of actual minerals. One table gives useful factors required for the conversion, and a second shows the conversion, with empirical analyses above and rational below, for 20 rocks.—E.S.L.

3159 **Shier, Daniel Edward.** Vermetid reefs and coastal development in southwest Florida [abs.]: Dissert. Abs., v. 26, no. 3, p. 1594–1595, 1965.

2914 **Shreveport Geological Society.** Cretaceous of southwest Arkansas—Field Trip, Apr. 1965 Guidebook: Shreveport, La., Shreveport Geol. Soc., 35 p., illus., table, 1965.

Besides the road log for a two-day field trip the guidebook contains geologic and structure sections, a correlation chart of the Cretaceous, and plates showing the macrofauna.—E.S.L.

3059 **Silverberg, Robert.** The world of coral: New York, Duell, Sloan and Pearce, 150 p., illus., 1965.

This book, written for popular consumption, describes different types of corals, tells how reefs grow, the types of life on them, their geographic distribution, and how coral islands form. The growth of our knowledge of reefs and atolls is traced and the scientists involved mentioned. One chapter is devoted to the Great Barrier Reef. The book is illustrated by photographs taken by the author's wife.—E.S.L.

2851 **Silverman, Daniel; Sparks, N. R.** Some experiments on multiple reflection cancellation: Geophysics, v. 30, no. 6, p. 1085–1093, illus., 1965.

One possibility of improving the matching of synthetic with field records involves use of the Earth itself as the "synthetic record computer." Upcoming (or downgoing) primary signals are fed back into the Earth with a vibrator in proper amplitude and phase to create a synthetic record of multiples only, which should match the multiples on the field record. Two experimental programs are reported. One, using an analog network to simulate near-surface and deeper formations with means to feed back the upcoming signals in proper timing and polarity to cancel the multiples, indicated the theoretical workability of the process. The second used a vertical spread to detect the upcoming and downgoing signals, and a hydraulic vibrator to impress those signals back into the Earth; these experiments were not conclusive, but indicated possible ways in which the method might be developed.—D.B.V.

Simons, D. B. *See* Chang, F. M. 2867

3063 **Simpson, George Gaylord.** The geography of evolution: Philadelphia, Pa., Chilton Books, 249 p., illus., tables, 1965.

The seven parts making up this book were originally essays or lectures, prepared over a period of years and published separately. A brief review of evolutionary explanation is followed by an example of the gathering and codification of data—evidence of periodicity in the fossil record. Current problems of observation and interpretation bearing on evolution are then more broadly considered for the vertebrates. The rest of the book, the greater part, is devoted to the geographic elements in evolution.—*from* Author's preface

Skalský, Lumir. *See* Wirth, Hans. 3079

Skippen, George B. *See* Crocket, James H. 3090

3270 **Slemmons, D. B.; Gimlett, J. I.; Jones, A. E.; Greensfelder, R.; Koenig, J.** (compilers). Earthquake epicenter map of Nevada: Nevada Bur. Mines Map 29, scale 1:1,000,000, text, 1964.

During the period from about 1852–1961, 1,173 earthquakes with Nevada epicenters were felt, 586 with Richter magnitudes above 4.0 were recorded, and approximately 220 were reported in non-specific terms. It is believed that no events of magnitudes over 6.0 have been missed since about 1860. The map shows a strong concentration of activity into three seismic zones, the first two of which cross each other in the Cedar Mountain–Excelsior Mountain area: (1) western Nevada–eastern California seismic zone, (2) the 118° meridian seismic zone, and (3) the southern Nevada transverse zone. A brief description is given of each zone. The map sheet includes

a table of destructive and near-destructive earthquakes, indicating date, time, latitude, longitude, and magnitude, with remarks on each.—M.C.M.

Smirnov, V. I. *See* Kutina, Jan. 2931

Smith, A. Gilbert. *See* Bullard, Edward. 3067

Smith, C. W. *See* Boynton, G. R. 3261

Smith, C. W. *See* Boynton, G. R. 3262

Smith, C. W. *See* Boynton,G. R. 3263

Smith, C. W. *See* Boynton, G. R. 3264

Smith, C. W. *See* Boynton, G. R. 3265

Smith, C. W. *See* Boynton, G. R. 3266

Smith, C. W. *See* Boynton, G. R. 3267

Smith, C. W. *See* Boynton, G. R. 3268

Smith, C. W. *See* Boynton, G. R. 3269

Smith, F. C. *See* Petty, A. J. 2970

3243 **Smith, Gerald Ray.** Distribution and evolution of the North American fishes of the subgenus *Pantosteus* [abs.]: Dissert. Abs., v. 26, no. 6, p. 3549, 1965.

3329 **Smith, J. V.; Stenstrom, R. C.** Chemical analysis of olivines by the electron microprobe: Mineralog. Mag., v. 34, no. 268, p. 436–459, illus., tables, 1965.

Techniques and results are reported of analyses by electron-microprobe of 31 natural olivines for Mg, Fe, Mn, Ca, Ni, and Co. Twenty-five had been analyzed previously by wet chemical methods, and 21 had been used by Yoder and Sahama to prepare a determinative curve between mole percent Fo and the lattice spacing d_{130}. It was found that microprobe analyses for most major and minor elements in common silicates can be made with an accuracy of about 0.5 to 5 percent of the amount present in about 1 minute for each group of three elements. Analytical results are tabulated.—V.S.N.

3071 **Smith, John Ward.** Conversion constants for Mahogany-zone oil shale: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 167–170, 1966.

In oil shale from the Mahogany zone of the Green River Formation in Colorado, the ratio of oil yield to organic matter (weight percent) is 0.659; the ratio of oil yield to organic carbon (weight percent) is 0.818; the ratio of organic matter (weight percent) to oil yield (gallons per ton) is 0.580, and the ratio of organic carbon (weight percent) to oil yield (gallons per ton) is 0.467.—W.C.C.

Smith, R. K. *See* Mapel, W. J. 2855

2779 **Sohl, Norman F.** Collecting in unconsolidated sediments, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 155–159, 1965.

The Upper Cretaceous outcrop belt of the Atlantic and Gulf Coastal Plains offers an almost unparalleled opportunity for collecting a wide variety of Mesozoic invertebrate fossils. Techniques for handling weathered specimens, excavating others, and packing, are illustrated from personal experience in particular localities. Notes on problems with individual groups of fossils are included.—E.S.L.

2823 **Sohl, Norman F.; Yochelson, Ellis L.; Kauffman, Erle G.** Gastropods and pelecypods, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 49–53, 1965.

Collection techniques based on the type of fossil and method of preservation, and methods of preparation suited to the specimen's size, shape, preservation, and to the nature of the matrix, are described.—E.S.L.

3066 **Sosman, Robert B.** The phases of silica: New Brunswick, N. J., Rutgers Univ. Press, 388 p., illus., tables, revised 1965; originally published 1927.

The basal material of this book appeared as Chapters 1 to 14 of the 1927 Properties of silica. Development of properties were left for later publication. In this edition Sosman examines the composition and electronic constitution of silica, its crystalline phases (their high–low inversions, and their reconstructive conversions), the formation and reversion of the amorphous phases, the complex phases and the defects that produce them, the effects of subdivision and twinning, the microforms of silica, conversion and inversion in the microforms, the symmetry of the modifications of silica, the ultimate structure of crystalline silica, the ultimate structure of amorphous and liquid silica, the system SiO_2–H_2O.—E.S.L.

2865 **Soward, Kenneth S.** Geology of damsites on Flathead River, mouth to Flathead Lake, Lake and Sanders Counties, Montana: U.S. Geol. Survey Water-Supply Paper 1550, 91 p., illus., table, geol. maps, 1965.

The investigations on which this report is based are part of the continuing program of evaluating the waterpower potential of streams affecting public lands. Geologic conditions are described of eight damsites that have been mapped on the lower Flathead River between miles 3 and 72 in Lake and Sanders Counties. Geologic maps and sections of the damsites are included.—W.L.G.

Sparks, N. R. *See* Silverman, Daniel. 2851

3138 **Spelman, Allen Rathjen.** Stratigraphy of Lower Ordovician Nittany Dolomite in central Pennsylvania [abs.]: Dissert. Abs., v. 26, no. 4, p. 2139–2140, 1965.

Stainforth, R. M. *See* Salvador, A. 3170

3308 **Steere, William C.** The boreal bryophyte flora as affected by Quaternary glaciation, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 485–495, illus., 1965.

This is a worldwide study based on data from identification of fossil and subfossil bryophytes, and from analysis of present geographical distribution. Several patterns of disjunct geographical distribution are identified and discussed. Various agents active in the dispersal of plants are reviewed.—E.S.L.

Steinbrugge, Karl V. *See* Radbruch, Dorothy H. 2980

Stenstrom, R. C. *See* Smith, J. V. 3329

2874 **Stenzel, H. B.** Stratigraphic and paleoecologic significance of a new Danian brachiopod species from Texas [with English, French, and Russian abs.]: Geol. Rundschau, v. 54, no. 2, p. 619–631, illus., 1965.

Three species of brachiopods are found at the type locality of the Littig phosphorite-cobble paraconglomerate at the base of the Midway Group (Danian). One of the three, a chitinophosphatic inarticulate brachiopod, is probably contemporaneous with the conglomerate. It is described from upper valves as *Discinisca* (*Discradisca*) *littigensis* n. sp. and is the oldest of the four Disciniscas known from the Gulf, the Atlantic Coastal Plains, and the Caribbean region. Two subgenera are proposed: *Discinisca* s. s. and *Discradisca* n. subgen. The geographic distribution of the genus in the Americas and its bathymetric range are discussed with the conclusion that both are too widespread to be useful in paleoecological interpretation.—*from* Author's abstract

3314 **Stephenson, Robert L.** Quaternary human occupation of the Plains, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 685–696, illus., 1965.

The plains region of the United States has been occupied by man for at least 15,000 or 20,000 years, and perhaps for as much as twice that long. Three sequential stages of human development are considered, each of which can be subdivided. The Paleo-Indian stage includes the earliest inhabitants, for whom there is very little evidence, and the big game hunters. The Archaic stage includes nomadic foragers, and the Sedentary stage includes the incipient and developed agriculturalists.—E.S.L.

Sterling, Philip J. *See* Stone, Charles G. 3073

Stevens, R. D. *See* Norris, D. K. 2920

2788 **Stewart, Wilson N.; Taylor, Thomas N.** The peel technique, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 224–232, illus., 1965.

The technique involves treating a prepared surface with acid, applying a thin coat of plastic in a liquid form or as a sheet of cellulose acetate, allowing it to dry, then removing the peel. Development of the technique is traced, and steps for making liquid or acetate sheet peels described. A section on the making of slides is included.—E.S.L.

3160 **Stibbe, Ehud.** A field method for the determination of the hydraulic conductivity of various soil layers in a profile with the aid of isolated undisturbed monoliths [abs.]: Dissert. Abs., v. 26, no. 3, p. 1595, 1965.

2800 **Stinemeyer, E. H.** Microfossil vacuum-needle segregating pick, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 276–283, illus., 1965.

When large numbers of microfossils must be separated from unwanted material, much time can be saved by using the vacuum needle. The assembly is illustrated with instructions for construction, and techniques of its use are discussed.—E.S.L.

2935 **Stirton, R. A.** Cranial morphology of *Castoroides*, *in* Dr. D. N. Wadia Commemorative Volume: Calcutta, India, Mining, Geol. and Metall. Inst. India, p. 273–289, illus., table, 1965.

The giant beaver, *Castoroides ohioensis*, is believed to have been eight or nine feet long and possibly weighed 480 pounds. The gouge shaped incisors, their long projection, and other features of the cranium do not support the idea that the giant beaver felled large trees; neither do the insertion and attachment areas of the cranial muscles. There is no evidence that it built dams. It is assumed that it preferred swamp lakes and ponds, and perhaps had habits like those of the modern muskrat, *Ondatra*. Eventual reduction and disappearance of its preferred environments in the late Pleistocene probably was influential in its extinction. The cranium is described in detail for comparison with Tertiary beavers.—*from* Author's abstract

Stoltman, James B. *See* Williams, Stephen. 3286

3073 **Stone, Charles G.; Sterling, Philip J.** Cretaceous-Paleocene boulder deposit, central Arkansas: Geol. Soc. America Bull., v. 76, no. 12, p. 1393–1400, illus., 1965.

A conglomerate, at the base of the Paleocene Clayton Formation, forming a narrow discontinuous belt for 6 1/2 miles southwest from Benton, contains large boulders of Arkansas novaculite. The conglomerate rests unconformably on the Womble Shale (Ordovician). The large size of the novaculite boulders, as much as 14 feet in diameter, and the distance of 3 1/2 miles from the nearest outcrop of novaculite lead the writers to postulate transportation of the boulders by mudflow during very Late Cretaceous or very early Paleocene time.—R.G.Y.

2991 **Stow, Stephen H.** A radiometric and chemical study of the binary Fitzwilliam Granite of New Hampshire [abs.]: Houston Geol. Soc. Bull., v. 8, no. 5, p. 18, 1966.

2799 **Stucker, G. F.; Galusha, M. J.; McKenna, M. C.** Removing matrix from fossils by miniature sandblasting, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 273–275, 1965.

An airbrasive machine is described and suggestions made regarding abrasive to be used. No description of techniques can be definitive because each specimen presents its own problems, but some general suggestions are given.—E.S.L.

3113 **Stueber, Alan Michael.** A geochemical study of ultramafic rocks [abs.]: Dissert. Abs., v. 26, no. 5, p. 2693, 1965.

2984 **Sutherland, D. S.** Nomenclature of the potassic–feldspathic rocks associated with carbonatites: Geol. Soc. America Bull., v. 76, no. 12, p. 1409–1412, table, 1965.

The terminology used in describing the potassic–feldspathic rocks associated with carbonatites is inconsistent. This paper discusses the nomenclature and proposes definitions of the terms and a scheme of classification.—Author's abstract

3183 **Sutton, R. G.; Rukavina, N. A.; Towle, E. L.** Lake Ontario shoreline processes and evolution at Braddock Heights, New York—Report of progress, *in* Conf. on Great Lakes Research, 8th, Ann Arbor, 1965, Proc.: Michigan Univ. Great Lakes Research Div. Pub. 13, p. 240–247, illus., table, 1965.

In the offshore area of Lake Ontario near Braddock Heights, N. Y., sand in deeper water is rather poorly sorted, coarser grained, and contains a high percentage of fines; and in shallow water, is well sorted and finer grained. The first type is deposited in deep water at times of storm activity; the second is a product of wave action and longshore currents from the northwest. Cores reveal an organic rich layer that represents older bay deposits buried when the lake level rose. Drumlins that flanked the older bay were eroded away and their sites are marked by boulders. The planned construction of an artificial shoal in the study area will afford a unique opportunity to study the changes in sediment distribution resulting from the modified current and wave patterns.—*from* Authors' abstract

3202 **Swain, F. M.** Geochemistry of some Quaternary lake sediments of North America, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 765–781, illus., tables, 1965.

The general characteristics of lake sediments of unglaciated and glacial regions are given. The inorganic geochemistry of six selected lake and pond deposits, and organic geochemistry of seven selected lake and bog deposits, are discussed and the analyses tabulated. Developmental history of lakes in glaciated regions is reflected in both inorganic and organic sedimentary residues. They have had different geochemical histories from those distant from continental ice.—E.S.L.

3161 **Swift, Donald Josiah Palmer.** Origin of the Cretaceous Peedee Formation of the Carolina Coastal Plain [abs.]: Dissert. Abs., v. 26, no. 3, p. 1595–1596, 1965.

3045 **Swingle, George D.** Mineral resources summary of the Morristown quadrangle, Tennessee: Nashville, Tennessee Div. Geology, 10 p., 1965.

This text accompanies Tennessee Div. Geology Geol. Map GM–163–NE by C. R. L. Oder and R. C. Milici (cited separately) and describes the limestone, dolomite, and iron ore resources in the Morristown quadrangle. Although much of the rock is obscured by thick overburden, almost unlimited reserves of limestone and dolomite are present in the Chepultepec Dolomite, Nolichucky Shale, Knox Group, and Lenoir Limestone. Iron has been mined in the upper parts of the Mascot and Longview Dolomites. Manganese has been found in the lower part of the Copper Ridge Dolomite, but because of poor exposures little can be determined about the

size, extent, and grade of the deposits. Potential resources are shale, clay, and chert.—M.C.M.

Takeda, Hiroshi. *See* Ross, Malcolm. 2994

3199 **Tanner, William F.** High-index ripple marks in the swash zone: Jour. Sed. Petrology, v. 35, no. 4, p. 968, 1965.

The swash zone produces ripple marks that have higher indices (30–100) than water-current and water-wave ripples and relatively high symmetry in comparison with eolian ripple marks.—E.J.C.

2772 **Tasch, Paul.** Branchiopods, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 89–94, 1965.

Branchiopoda embrace seven orders, which can be placed in three large groups in each of which the subtended orders show close affinities. Each of these groups is discussed in some detail, with special emphasis on the question of where to look for specific fossil branchiopods. Silurian beds anywhere in the world may contain crucial evidence bearing on the evolution of branchiopods in particular, and post-Silurian crustaceans in general.—E.S.L.

2786 **Tasch, Paul.** A biofacies approach to collecting nonmarine fossils, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 206–211, 1965.

Of all possible living invertebrates that inhabit nonmarine environments, only the Mollusca and Arthropoda are frequently found as fossils. Many are found in conchostracan bearing beds. Types of beds found to be good indicators of the possible presence of fossils are listed and described. Measurement and sampling of the section should be made in inches or millimeters. It is essential to study multiple sections or to trace and sample beds laterally because many of the animals lived in marginal puddles or peripheral zones of ponds and lakes.—E.S.L.

Taylor, D. W. *See* Hibbard, C. W. 3335

3338 **Taylor, D. W.** The study of Pleistocene nonmarine mollusks in North America, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 597–611, illus., tables, 1965.

Regional differences shown by living molluscan fauna are shown also by Pleistocene faunas. In this study emphasis is placed on central North America because of these differences and more numerous data. Most of the independently dated faunas are summarized and their parallelism with Czechoslovakia discussed. Late Cenozoic climates inferred from these fossil assemblages are shown in a table. In general, Pleistocene events extinguished pre-existing species and scarcely any evolutionary replacement occurred.—E.S.L.

Taylor, Thomas N. *See* Stewart, Wilson N. 2788

3061 **Taylor, W. H.** Framework silicates—The feldspars, Chap. 14 *of* The crystalline state—V. 4, Crystal structure of minerals: Ithaca, N. Y., Cornell Univ. Press, p. 293–339, illus., tables, 1965.

The structural studies are discussed under three main headings: First, the structural scheme common to all feldspars is described, and shown to account for many features characteristic of different members of the family. Second, details of the principal feldspar structures are given, with special reference to the distribution of Al and Si atoms in the tetrahedral groups and to the nature of the environment of the cations K, Ba, Na, and Ca. Third, the structures of the series of mixed K—Na, K—Ba, and Na—Ca feldspars are discussed. In this treatment the distinction between low-temperature and high-temperature materials becomes obvious, particularly in relation to order-disorder effects.—E.S.L.

2907 **Tectonic Map of Canada Committee.** Tectonic map of the Canadian Shield: Canada Geol. Survey Prelim. Ser. Map 4–1965, scale 1:5,000,000, text, 1965.

The four main orogenic regions of the Canadian Shield are the Kenoran, Hudsonian, Elsonian and Grenville. As a general rule, each orogenic episode was followed by a long period of erosion and by the unconformable deposition of overlying sedimentary and volcanic materials. Rock units on the map are depicted according to age of folding, metamorphism, and essentially contemporaneous emplacement of granitic rocks. Main headings in the legend show the last orogeny affecting any particular region, a second main category includes unfolded and gently folded rocks which have not been affected by orogeny, and a third includes post orogenic features.—M.C.M.

3236 **Terry, Richard Dean.** Continental slopes of the world [abs.]: Dissert. Abs., v. 26, no. 6, p. 3252, 1965.

Thaden, Robert E. *See* Lewis, Richard Q., Sr. 2861

3281 **Thaden, Robert E.; Lewis, Richard Q., Sr.** Geologic map of the Jabez quadrangle, Russell and Wayne Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-483, scale 1:24,000, section, text, 1966.

Extensive deposits of limestone in the Jabez quadrangle were quarried in the early 1900's. In the southern part of the area quite sandy limestone is widespread in the Salem and Warsaw Formations and may be up to 80 feet thick where fossiliferous shale is not present; and rather high-calcium-bearing reef limestone, some over 120 feet thick, is available in large quantities. High calcium-bearing limestone is available from the Monteagle Limestone (Mississippian). In the south-central part of the quadrangle a large body of limy and silty sandstone in the Fort Payne Formation might be useful as building stone. The quadrangle has not been thoroughly tested for oil, but production, if any, must come from possible reservoir rocks in the lowermost Fort Payne or from strata stratigraphically below the Chattanooga Shale.—M.C.M.

2967 **Thayer, T. P.; Brown, C. Ervin.** Geologic map of the Aldrich Mountain quadrangle, Grant County, Oregon: U.S. Geol. Survey Geol. Quad. Map GQ-438, scale 1:62,500, sections, separate text, 1966.

The pre-Tertiary rocks in the Aldrich Mountain quadrangle were described by Thayer and Brown in 1940, 1960, 1963, and discussion here is limited to Tertiary rocks. The Clarno Formation, mostly volcanic mudflows and reworked volcanic debris, ranges in thickness from 1,500 to 2,000 feet. The Columbia River Group here includes the Picture Gorge Basalt and the Mascall Formation. The Rattlesnake Formation consists of fanglomerate and poorly sorted finer materials deposited under semiarid conditions in structural lowlands formed by post-Mascall deformation. The Aldrich Mountain anticline probably originated in early Oligocene by folding and faulting of the Clarno Formation; present structural configuration was blocked out, probably in Pliocene, by rejuvenation of the anticline, related folding, and development of the John Day fault system.—M.C.M.

3162 **Thomas, Hugo Frederick.** Late-glacial sedimentation near Burlington, Vermont [abs.]: Dissert. Abs., v. 26, no. 3, p. 1596, 1965.

2949 **Thomas, William A.; Mann, C. John.** Late Jurassic depositional environments, Louisiana and Arkansas: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 178–182, illus., 1966.

The Upper Jurassic Cotton Valley Group is a sedimentary wedge, pinching northward, under the Gulf Coastal Plain from Texas to Alabama. In northern Louisiana, formations in this group are, in descending order, the Knowles Limestone, the Hico Shale which grades southward into the regressive, massive Terryville Sandstone, and the southward-thickening wedge of shale and limestone comprising the Bossier Formation. These formations grade northward into terrestrial red beds of the Schuler Formation, in Arkansas. Across northern Louisiana, a west-trending, longshore barrier island of (Terryville) sandstone

supplied by a delta to the ancestral Mississippi river separated a coastal lagoon (Hico shale) from the open gulf (marine Bossier Formation).—B.H.K.

3139 **Thompson, Robert Wayne.** Tidal flat sedimentation on the Colorado River delta, northwestern Gulf of California [abs.]: Dissert. Abs., v. 26, no. 4, p. 2140, 1965.

3114 **Thompson, Thomas Luther.** Conodonts from the Meramecian stage (Upper Mississippian) of Kansas [abs.]: Dissert. Abs., v. 26, no. 5, p. 2693, 1965.

2845 **Thyssen-Bornemisza, Stephen.** Correlating vertical magnetic intensity and average horizontal gradients of gravity: Geophysics, v. 30, no. 6, p. 1138–1140, illus., 1965.

Several small experimental profiles of average horizontal gravity gradients were taken over an area previously surveyed with the magnetometer in the Hope Forest area of South Australia. Small but important discrepancies between the center lines of the magnetic and gravity anomalies suggest dense but nonmagnetic capping of the buried bodies. Therefore, horizontal gradients of gravity observed with the gravimeter might serve as a useful supplementary exploration tool in similar problems, if observation points are suitably spaced and applied.—D.B.V.

2846 **Thyssen-Bornemisza, Stephen.** Double-track profiling with the gravity meter: Geophysics, v. 30, no. 6, p. 1135–1137, illus., 1965.

The technique of double-track profiling with the gravimeter, simultaneously providing gravity values and horizontal gravity gradients, is discussed briefly in connection with its possible advantage in marine exploration using the underwater gravimeter. An example is given of the application of the technique to detailed exploration in part of the Tennant Creek mining district in the Northern Territory of Australia.—D.B.V.

Tipton, M. J. *See* Lemke, R. W. 3244

2896 **Todd, Ruth; Low, Doris; Mello, James F.** Smaller foraminifers, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 14–20, 1965.

Two basic sampling methods, channel and spot sampling are discussed. Preparation techniques include washing, screening to size, picking, mounting, and storage. Special techniques included are avoidance of effects of static electricity, magnetic separation, staining, elimination of plant debris, heavy liquid separation, and excavation by needle.—E.S.L.

Towle, E. L. *See* Sutton, R. G. 3183

2759 **Traverse, Alfred.** Preparation of modern pollen and spores for palynological reference collections, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 598–613, illus., 1965.

Flowering plants first appear in the fossil record in the Lower Cretaceous. From that point on there is increasing utility in comparing modern angiosperm fossil types with fossil. Since the modern collection is an essential tool, the techniques of preparing, curating, and studying it are included here. Collecting from an herbarium is recommended. Maceration and mounting techniques are described and three preparation schedules given.—E.S.L.

3163 **Trexler, John Peter.** The geology of the Klingerstown, Valley View, and Lykens quadrangles, Southern anthracite field, Pennsylvania (V. 1–3) [abs.]: Dissert. Abs., v. 26, no. 3, p. 1596–1597, 1965.

2978 **Triplehorn, D. M.** Glauconite provides good oil search data: World Oil, v. 162, no. 1, p. 94–97, illus., 1966.

Glauconite usually forms under reducing conditions in shallow marine water, that is, in the best environment for generation of hydrocarbons. Glauconite rarely survives erosion and redeposition in nonmarine environments, and is not known

to occur in saline lakes nor in freshwater deposits. Its main geologic applications are as an environmental indicator, a correlation tool, an unconformity or diastem tracer, and for radioactivity age determination.—*from* Author's abstract

3146 **Turner, Roosevelt.** Kinetic studies of acid dissolution of montmorillonite and kaolinite [abs.]: Dissert. Abs., v. 26, no. 3, p. 1277, 1965.

Tynes, Eugene W. *See* Blank, Horace R. 3015

2977 **Uchupi, Elazar.** Topography and structure of Northeast Channel, Gulf of Maine: Am. Assoc. Petroleum Geologists Bull., v. 50, no. 1, p. 165–167, illus., 1966.

Seismic profiles indicate a buried trough 120 m below the present surface of Northeast Channel. Northeast Channel probably was formed by fluvial action, submerged, modified by glacial action, then was partly filled during the reworking of outwash deposits.—W.C.C.

3215 **Ulmer, Gene Carlton.** Oxidation–reduction reactions and equilibrium phase relations at 1300°C at oxygen pressured from 0.21 to 10 ^{14} atmospheres for the spinel solid solution series $FeCr_2O_4$–$MgCr_2O_4$ and $FeAl_2O_4$–$MgAl_2O_4$ [abs.]: Dissert. Abs., v. 26, no. 6, p. 3070–3071, 1965.

3075 **Ulrich, George E.** Geologic map of the Sharon Grove quadrangle, Todd and Logan Counties, Kentucky: U.S. Geol. Survey Geol. Quad. Map GQ-482, scale 1:24,000, section, text, 1966.

A small amount of coal from a bed two to three feet thick in northwestern Sharon Grove quadrangle was mined prior to 1930. Shows of oil and gas have been reported in the Big Clifty Sandstone Member (Jackson sand) of the Golconda Formation and in the Paint Creek Limestone (exposed in the quadrangle); in the Late Mississippian Ste. Genevieve, St. Louis, and Warsaw Limestones (not exposed); and in thin sandstone and shale breaks below the Chattanooga Shale. Quartz sandstone occurs in an even-bedded layer about 20 feet thick, 50–100 feet above the base of the Caseyville Formation and may have potential value as glass or molding sand.—M.C.M.

3078 **Umschau.** Die pazifische Erdbebenzone und das Beben von Alaska: Umschau, v. 65, no. 20, p. 649–650, illus., 1965.

The Alaska earthquake of March 27, 1964 threw further light on fault planes of the northeast Pacific earthquake belt. The epicenter of the main shock lay south of the Chugach Mountains in the Prince William Sound fiord country; epicenters of the seven main aftershocks were in the Gulf of Alaska from Kodiak Island to the coast between Valdez and Cordova. Up to May 27, 12,000 more small shocks were recorded. The earthquake energy (about 3×10^{24} ergs) generated tsunami which caused damage from Kodiak to southern California, and reached Antarctica 22 hours later.—D.B.V.

2993 **Urey, Harold C.** Biological material in meteorites—A review: Science, v. 151, no. 3707, p. 157–166, illus., tables, 1966.

If the materials discussed here were of terrestrial origin, it would be firmly suggested that the materials were of biological origin and indigenous to the meteorites.

A contrary explanation would be that some organisms invaded these meteorites, which have fallen all over the Earth during more than century, and which have been stored on dry museum shelves, and that they grew vigorously for a short period and produced a record that in many ways duplicates what we find in very old terrestrial sediments, particularly in that they appear to lack important compounds such as those found in more recent soils and sediments of the Earth—that is, chlorins—but contain compounds present in very old sediments—that is, porphyrins, fatty acids, hydrocarbons, and so on. Many lines of evidence, as briefly reviewed above, strongly suggest that biogenic material exists in these meteorites and that it may be indigenous.—Author's abstract

2904 **U.S. Geological Survey.** (Alaska and Glacial Map Committee). Map showing extent of glaciations in Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-415, scale 1:2,500,000, text, 1965.

Colored patterns on the map show areas covered by existing glaciers; by ice during glacial advances within the past 6,000 years, and during four Pleistocene glaciations; by proglacial lakes during parts of Pleistocene time; and by ice during Pleistocene glacial advances of undetermined sequence. Symbols indicate localities formerly covered by glacial ice but too small to map, outer limits of significant glacial advance, 300-ft submarine contour, inferred position of former ice divide, inferred direction of former ice movement, contours on inferred surface of glaciers of late Pleistocene age, and prominent moraines. Sources of information are listed. M.C.M.

3093 **Vadnais, Raymond R., Jr.** Quantitative terrain factors as related to soil parent materials and their engineering classification [abs.]: Dissert. Abs., v. 26, no. 5, p. 2640, 1965.

3298 **VanHeerden, Willem Maartens.** Splash erosion as affected by the angle of incidence of raindrop impact [abs.]: Dissert. Abs., v. 26, no. 6, p. 3181-3182, 1965.

2857 **VanLandingham, Sam L.** Evidence for microfossils in the Alais and Orgeuil carbonaceous meteorites: Nature, v. 208, no. 5014, p. 947-948, illus., 1965.

Thirty indigenous forms have been found in acid-resistant particles separated from the Alais and Orgeuil carbonaceous chondrites. Some appear to be identical with microstructures described by earlier investigators. This work confirms earlier findings regarding the presence of microstructures in carbonaceous meteorites. Their exact origin is still not known, but it does not seem likely that all can be accounted for as either biologic contaminants or mineral artefacts.—D.B.V.

3123 **VanSchaik, Jacob Cornelis.** Ion diffusion in clay-water systems [abs.]: Dissert. Abs., v. 26, no. 4, p. 1943, 1965.

Vargo, J. L. *See* Petty, A. J. 2970

Velzeboer, C. J. *See* Seriff, A. J. 2841

2875 **Vink, A. P. A.** Prof. Dr. ir. C. H. Edelman, 1901-1964: Geol. Rundschau, v. 54, no. 2, p. 1320-1322, 1965.

3330 **Wager, L. R.** The form and internal structure of the alkaline Kangerdlugssuaq intrusion, East Greenland: Mineralog. Mag., v. 34, no. 268, p. 487-497, illus., geol. map, 1965.

The Kangerdlugssuaq intrusion is the largest Tertiary igneous complex in the vicinity of the Kangerdlugssuaq Fjord; it is circular with a diameter of about 33 km. The outer part is nordmarkite and toward the center are rings of transitional pulaskite, and main pulaskite, ending with foyaite in the center. There are no sharp breaks between types. The petrographic implications of this three-dimensional disposition of rock types are discussed.—V.S.N.

3254 **Wahrhaftig, Clyde; Birman, J. H.** The Quaternary of the Pacific mountain system in California, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 299-340, illus., tables, 1965.

The physiographic provinces of California are described briefly. Quaternary volcanic rocks of the Sierra Nevada range in age from 3.8 m.y. to 5,000 yr. Six glaciations have been recognized in the Sierra, and three small post-Altithermal advances. Quaternary alluvium in the Great Valley ranges up to 1,500 m in thickness. The deformed Quaternary along the southwest margin of the valley is here named the Tulare Formation. The structural valleys of the southern Coast Ranges are bordered by deformed Pliocene-Pleistocene sediments, and younger undeformed alluvium underlies the centers. Late Pliocene and Quaternary volcanic fields in the southern part of the northern Coast Ranges are associated with continental sedimentation

in local basins. In southern California, the marine lower Pleistocene is 900 m to 1,850 m thick in the Ventura and Los Angeles basins. As many as 13 and 20 marine terraces have been recognized.—E.S.L.

Wanless, R. K. *See* Norris, D. K. 2920

3237 **Warner, Don Lee.** An analysis of the influence of physical-chemical factors upon the consolidation of fine-grained clastic sediments [abs.]: Dissert. Abs., v. 26, no. 6, p. 3252–3253, 1965.

3192 **Warner, Mont M.** Cementation as a clue to structure, drainage patterns, permeability, and other factors: Jour. Sed. Petrology, v. 35, no. 4, p. 797–804, illus., 1965.

Sandstone, mudstone, and conglomerates of the Eocene Duchesne River Formation of Duchesne and Uintah Counties, Utah, occupy a 1,000 sq mi area in the Uinta Basin south of their source area, the Uinta Mountains. Cementation occurred in three stages. Regional distribution of quantity and kind of cement is certainly related to source rocks, surface drainage, and distance from source, and possibly to local structure, and ground-water movement. Further studies may establish rules for predicting nature of cements in sediment from type of source rock, or kinds of sources, distance of transport, permeability, and local structure from distribution pattern of cements.—R.A.C.

Wass, Marvin L. *See* Harrison, W. 3282

2995 **Wasson, B. E.; Golden, H. G.; Gaydos, M. W.** Water for industrial development in Clay, Lowndes, Monroe, and Oktibbeha Counties, Mississippi: Jackson, Miss., Mississippi Research and Devel. Center, 39 p., illus., tables, 1965.

Clay, Lowndes, Monroe, and Oktibbeha Counties are underlain by sedimentary beds of Cretaceous age which dip about 25 feet per mile to the southwest and vary widely in permeability. The Cretaceous beds overlie Paleozoic rocks, the top of which coincides approximately with the base of fresh water in the western part of the area. Several million gallons per day of ground water can be developed at any locality in the area, but in some localities the aquifers are much more productive than in others. The Gordo and Coker Formations are the most permeable and highest yielding aquifers, and yields of individual wells are as much as 2,000 gpm. The Eutaw is preferred by many users over the deeper McShan, Gordo, and Coker Formations because the water usually is free of objectionable iron.—*from* Authors' abstract

3241 **Watkinson, David Hugh.** Melting relationships in parts of the system Na_2O–K_2O–CaO–Al_2O_3–SiO_2–CO_2–H_2O with applications to carbonate and alkalic rocks [abs.]: Dissert. Abs., v. 26, no. 6, p. 3386, 1965.

3238 **Watson, Stuart T.** Petrography and lithostratigraphy of some south Louisiana subsurface Tertiary rocks [abs.]: Dissert. Abs., v. 26, no. 6, p. 3253, 1965.

3018 **Watterson, Juan.** Plutonic development of the Ilordleq area, South Greenland—Pt. 1, Chronology, and the occurrence and recognition of metamorphosed basic dykes: Medd. om Grønland, v. 172, no. 7, 147 p., illus., geol. maps, 1965; reprinted as Grønlands Geol. Undersøgelse Bull. 51, 1965.

The rocks of Ilordleq are products of two plutonic episodes and the accompanying deformation. The first (Ketilidian) deformation, which took place before and during the arrival of the granite, gave rise to fold structures in the layered supracrustal rocks. A belt of pre-granite rocks preserved in the north, and isolated remnants remaining as enclaves, are cut by basic dikes. The two plutonic episodes were separated by a tensional period during which more basic dikes were intruded. The second (Sanerutian) episode resulted in reactivation of much of the granite, especially in the north where it shows evidence of flow in the solid state. In a less reactivated area augen granites were formed where the supracrustal enclaves were most deformed. Further emplacement of basic dikes, controlled by shear fractures, took

place in the closing stages. More swarms of basic dikes were emplaced during the Gardar episode.—E.S.L.

3120 **Wayne, William J.** The end moraines of the Cartersburg till member in central Indiana [abs.]: Indiana Acad. Sci. Proc. 1964, v. 74, p. 223, 1965.

3246 **Wayne, William J.; Zumberge, James H.** Pleistocene geology of Indiana and Michigan, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 63–84, illus., tables, 1965.

Deposits representing the Kansan, Illinoian, and Wisconsin Stages have been recorded in Indiana. Over buried valleys or lowlands these sediments are more than 150 m thick in places. A correlation chart of Pleistocene stratigraphic terms and geologic-climate units is included. The surface geology of Michigan is dominated by glacial drift of three Wisconsin substages. The location of moraines and types of drift are described. No interstadial deposits have been positively identified. The geologic history of the Great Lakes is so tied in with these states that it is included here. Tertiary stream-valley erosion, and modification by glacial erosion and deposition have been proposed as processes to account for basin origin. Crustal warping is discussed briefly and hinge lines are shown on a map. A history of each of the ancestral lakes is given and correlation charts included.—E.S.L.

3256 **Weaver, Donald W.** Summary of Tertiary stratigraphy, western Santa Ynez Mountains, *in* Western Santa Ynez Mountains, Santa Barbara County, California—Coast Geol. Soc. and SEPM Pacific Sec., Field Trip, 1965 Guidebook: [n.p.] Coast Geol. Soc., p. 16–30, tables, 1965.

The Santa Ynez Mountains are a part of the Transverse Ranges which appear to belong to the same system of deformation as the Murray Escarpment. The western end of the mountains has long been known for the stratigraphic continuity of Upper Cretaceous and Tertiary beds. The stratigraphy of the Eocene–Miocene formations is given and terrestrial and marine interfingering is shown diagrammatically. Foraminifera from the Poppin Shale and Gaviota–Alegria Formations are listed. Columnar sections accompany the paper.—E.S.L.

3309 **Weber, W. A.** Plant geography in the Southern Rocky Mountains, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 453–468, illus., 1965.

The southern Rocky Mountain flora contains the following elements and subelements: 1. Circumpolar, which includes Boreal–Asiatic, Boreal–American, Central Rocky Mountain–Pacific Northwest, and Northern Rocky Mountain subelements; 2. Madro–Tertiary, which includes Tertiary-relict, Chihuahuan, Sonoran–Great Basin, and alpine–desert disjunct subelements; and 3. Eastern Woodland–Prairie elements. These are described, the distribution patterns shown on diagrams, and the relationship to past events discussed.—E.S.L.

3047 **Weill, D. F.** Stability relations in the Al_2O_3–SiO_2 system calculated from solubilities in the Al_2O_3–SiO_2–Na_3AlF_6 system: Geochim. et Cosmochim. Acta, v. 30, no. 2, p. 223–237, illus., tables, 1966.

Measurement of the solubilities of andalusite, kyanite, sillimanite, mullite, tridymite, and quartz in liquids of the Al_2O_3–SiO_2–Na_3AlF_6 system at 1,010° and 800°C shows that the Gibbs free energy of solid phases in the alumina–silica system can be simply related to the activity of silica in the liquid with which they are in equilibrium. The free energy relations are calculated for the different reactions. A P–T phase diagram is caloulated for the solid alumina–silica system which gives a triple point, andalusite–kyanite–sillimanite, at about 410°C, 2,400 bars. The P–T curve for muscovite + quartz $\rightleftharpoons$ K-feldspar + sillimanite + water lies about 60–80°C below the curve for the simple breakdown of muscovite.—D.B.V.

Weis, Paul L. *See* Richmond, Gerald M. 3300

3178 **Weiss, Malcolm P.; Wenden, Henry E.** Calcite spherulites from the Morrison Formation, Wyoming: Jour. Sed. Petrology, v. 35, no. 4, p. 985–988, illus., 1965.

Calcite spherulites form 85 percent of a spherulitic limestone in the Morrison Formation that is considered to have formed in an alkaline flood-plain lake with little detrital sedimentation.—H.A.T.

2939 **Weller, J. Marvin.** Palaeontology, evolution and taxonomy, *in* Dr. D. N. Wadia Commemorative Volume: Calcutta, India, Mining, Geol. and Metall. Inst. India, p. 217–225, 1965.

Biologists have contributed more to evolutionary understanding than palaeontologists. Nevertheless, evolutionary reconstructions must conform to the palaeontological record. Vertebrate palaeontologists and palaeobotanists generally have been conscious of the biologic aspects of their studies. Most invertebrate palaeontologists have been deficient in this respect. Commonly they have considered taxonomic and evolutionary studies to be the same. Taxonomy, however, cannot express evolutionary patterns adequately. Too much reliance has been accorded taxonomy in evolutionary reconstructions.—Author's abstract

Wenden, Henry E. *See* Weiss, Malcolm P. 3178

Wengerd, Sherman A. *See* Mather, Kirtley F. 3016

3188 **Wertz, Jacques B.** L'entaille et la capture d'arroyo—Accidents géologiques survenant aux vallées habituellement sèches du Sud-Ouest des États Unis [with English abs.]: Rev. Géomorphologie Dynamique, v. 15, nos. 10–12, p. 145–157, illus., 1965.

Two geomorphological accidents, arroyo cutting and capture, are studied by the technique of thalweg contour lines. This technique brings out: (1) either the progress or the lag in erosive activity occurring in channels, as compared to that affecting the intervening regions; (2) whether or not a channel may be subject to possible arroyo cutting; and (3) detection of past captures, as well as possible future captures. It has been observed that faults often are responsible for capture phenomena.—*from* Author's abstract

2879 **West, T. R.; Aughenbaugh, N. B.** The role of aggregate degradation in highway construction, *in* Highway geology symposium, 15th Ann., 1964, Proc.: Rolla, Missouri Div. Geol. Survey and Water Resources, p. 117–132, 1964.

Processes of aggregate breakdown in highways and history of research on the problem are reviewed. Both physical and chemical processes are involved in degradation, but usually one is dominant. Aggregate type and compactive effort are major factors influencing degradation; others are gradation, aggregate size, aggregate shape, time, water, weathering and secondary minerals, subgrade and subbase, aggregate structures, particle orientation, thickness of layer, climate, aggregate use. Regional setting is important; good routine laboratory tests can and should be developed on a regional basis where conditions are similar. Petrographic analysis seems to offer the best approach in establishing a standard universal test.—V.M.J.

3084 **West, Terry R.; Barr, David J.** Economic groundwater problems encountered in the development of a housing area near West Lafayette, Indiana: Indiana Acad. Sci. Proc. 1964, v. 74, p. 259–267, illus., 1965.

A shortage of available ground water was revealed in Homewood, near West Lafayette, when dry holes were drilled on several lots. The glacial cover is shown to increase eastward from Homewood on two isopach maps. Bedrock is the Borden Group and it is not water-bearing. A contour sketch map of the surface is included. One well reached the thicker glacial section, yielded ample water, and was made a community well.—E.S.L.

2871 **Weyl, Richard.** Die paläogeographische Entwicklung des mittelamerikanisch-westindischen Raumes [with English, French, and Russian abs.]: Geol. Rundschau, v. 54, no. 2, p. 1213–1240, illus., 1965.

Central America and the West Indies belong to the zone of circumpacific orogens, and may be divided into units according to paleogeographic development. In northern Central America, a Paleozoic core crops out in the mountain chains, whose continuation in the Antilles has often been discussed but not yet determined. More marine beds were deposited in the Lower Cretaceous, but in the Upper, the seas receded. In the Greater Antilles orogen, geosynclinal development started in Middle Jurassic, and at the end of the Cretaceous it underwent Laramide orogeny, followed by rapid erosion. Deposition began again in middle Eocene, followed by major deformation in the Miocene. Weyl favors the idea that a continental landmass occupied the position of the Caribbean Sea until the end of the Cretaceous. A structure map and 11 small paleogeographic maps are included.—E.S.L.

Wheeler, Walter H. *See* Atlantic Coastal Plain Geol. Assoc. 2982

3115 **Whitaker, Sidney Hopkins.** Geology of the Wood Mountain area (72–G) Saskatchewan [abs.]: Dissert. Abs., v. 26, no. 5, p. 2694, 1965.

2928 **White, D. E.** Metal contents of some geothermal fluids, *in* Symposium—Problems of postmagmatic ore deposition with special reference to the geochemistry of ore veins, Prague, 1963, V. 2: Prague, Geol. Survey of Czechoslovakia, p. 432–443, tables, 1965.

Recent investigations are summarized of the metal content of some natural fluids, emphasizing those in geothermal environments. The more soluble components, such as alkali and halogen groups of elements, are the most useful in determining the origin and history of thermal and mineral waters. Metal content of volcanic fumaroles, dilute chloride waters associated with geysers, thermal waters associated with mercury deposits, those depositing manganese oxides, those of high salinity, and hot spring areas, are discussed and tabulated. A spectacular geothermal brine from southern California is described.—E.S.L.

White, George W. *See* Goldthwait, Richard P. 3247

3310 **Whitehead, Donald R.** Palynology and Pleistocene phytogeography of unglaciated eastern North America, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 417–432, illus., 1965.

The physiography and present vegetation are reviewed briefly for purposes of comparison. A tentative reconstruction is presented of vegetation from full-glacial to the present for a transect extending from the Chesapeake Bay region to southeastern North Carolina. Pollen diagrams from Bladen County, N. C. and Dismal Swamp, Va., are given. In other areas in the unglaciated East considerable changes in vegetation are indicated also.—E.S.L.

3029 **Whitman, Harry M.** Estimating water quality from electrical logs in southwestern Louisiana: Louisiana Geol. Survey Water Resources Pamph. 16, 13 p., illus., table, 1965.

Concentrations of chloride and dissolved solids in the fresh and slightly saline water-bearing sands of the Chicot, Atchafalaya, and Evangeline aquifers of southwestern Louisiana can be estimated rapidly and accurately from graphs in this report and readings from electrical logs. These graphs are based on the concentration of dissolved minerals in water, the resistivity of the water, and the resistivity of the aquifer.—Author's abstract

Whittington, H. B. *See* Cooper, G. Arthur. 2803

2812 **Whittington, H. B.** Photography of small fossils, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 430–433, illus., 1965.

The author discusses the photographing of early-growth stages of trilobites at magnifications of 30 to 50 diameters. The apparatus he prefers is shown in a drawing and described.—E.S.L.

3206 **Wilcox, Ray E.** Volcanic-ash chronology, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 807-816, illus., table, 1965.

Several extensive ash-fall layers provide useful time-stratigraphic markers in the Quaternary deposits of the western United States. The Mazama ash erupted about 6,600 yr ago; to it belongs much of the ash previously called Glacier Peak and Galata. The ash fall that actually had its source at Glacier Peak is about 12,000 yr old. The Pearlette ash fall, of late Kansan age, spread over the Great Plains, and a very similar ash, of middle Quaternary age, has been found in the Rocky Mountains and into Nevada. The source of the Pearlette is still unknown. Many more Quaternary ash layers await investigation.—E.S.L.

3179 **Williams, Elizabeth M.** A method of indicating pebble shape with one parameter: Jour. Sed. Petrology, v. 35, no. 4, p. 993-996, illus., 1965.

A shape index is derived which indicates to what extent a pebble approximates an oblate or prolate spheroid and which may be treated as a single statistical variable.—Author's abstract

3286 **Williams, Stephen; Stoltman, James B.** An outline of southeastern United States prehistory with particular emphasis on the paleo-Indian era, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 669-683, illus., tables, 1965.

The time span of human occupation of the United States has been divided into three eras: a Paleo-Indian era, beginning prior to 15,000 B.C. and lasting until 6,500 B.C.; a Meso-Indian era, from 6,500 to 2,000 B.C.; and a Neo-Indian era, which extends from 2,000 B.C. to the present. The majority of the discussion is devoted to the Paleo-Indian era, and to the nature of the fluted-point tradition. A total of 1,142 points has been recorded from 13 states. Provenience data on each point were tabulated on the county level, and the distribution of fluted points was then studied within the natural framework of physiographic provinces and river systems.—E.S.L.

Willman, H. B. *See* Frye, John C. 3245

2999 **Wilson, Roland V.** Bibliography of graduate theses on Nevada geology: Nevada Bur. Mines Rept. 8, 14 p., illus., 1965.

The bibliography consists of three parts: an alphabetical list of graduate theses; an index in which each thesis is listed under one or more appropriate headings; and an index map on which are located all geologic maps that are parts of the theses. An original compilation, not published, had been a valuable source in preparing a geologic index map of Nevada in 1962.—M.C.M.

3271 **Wilson, Roland V.; Paul, Richard R.** Intrusive rocks of Nevada: Nevada Bur. Mines Map 30, scale 1:1,000,000, 1965.

Nevada Bureau of Mines Report 10 lists all the isotopic age determinations run on the post-Precambrian and Precambrian rocks indicated on the map sheet. M.C.M.

2941 **Windley, B. F.** The composite net-veined diorite intrusives of the Julianehåb district, South Greenland: Medd. om Grønland, v. 172, no. 8, 60 p., illus., tables, 1965; reprinted as Grønlands Geol. Undersøgelse Bull. 58, 1965.

Composite minor diorite intrusives from a plutonic environment of Precambrian granites are described. They are flanked by margins of aplitic granodiorite and are penetrated by granitic net-veins, which define a very characteristic pillow-shaped pattern. The diorite bodies were intruded during the Sanerutian period. A contraction crack-shear plane theory is proposed to explain the formation of the net-veins. The granitic material was produced by rheomorphism-at-depth from the recently reactivated granites, and it penetrated the diorite at least partly by recrystallization and replacement.—E.S.L.

2919 **Winkler, Helmut G. F.** Petrogenesis of metamorphic rocks (translated from German): New York, Springer-Verlag, 220 p., illus., tables, 1965.

This book is a translation, with modifications and revisions, of the German edition "Die Genese der metamorphen Gestein" (1965). It is based on a lecture course designed to evaluate the rapidly augmented knowledge on origin of metamorphic rocks. Stress is on mineralogical-chemical aspects of metamorphism, and reactions which transform the mineralogical composition of rocks when subjected to various metamorphic conditions within the Earth's crust. Petrofabric analysis and time relations between orogenesis and metamorphism are not discussed. It is hoped the book will serve as a textbook for students of petrology, geology, and geochemistry.—G.D.C.

3079 **Wirth, Hans; Skalský, Lumir.** Freie Schwingungen des Erdkörpers [with English summ.]: Gerlands Beitr. Geophysik, v. 74, no. 3, p. 230–232, illus., table, 1965.

Free oscillations of the Earth were recorded after the Alaska earthquakes of 1964 by two horizontal pendulums in the Vojtěch mine at the Březové Hory station in Czechoslovakia. Results of spectral analysis of the records, giving the periods of the spheroidal and torsional modes ${}_nS_l$ and ${}_nT_l$, for $l = 1$ to 25, are tabulated.—D.B.V.

Wones, David R. *See* Ross, Malcolm. 2994

3180 **Wood, Alan.** Conical slip-marks in shale [discussion of "A new type of conical structure in shale" by B. G. Woodland]: Jour. Sed. Petrology, v. 35, no. 4, p. 997, 1965.

In this discussion of Woodland's paper (ibid., v. 34, p. 680–683, 1964) it is noted that conical slip marks in shale were described as a fossil seed "*Guilielmites*" as early as 1858 but are in fact due to differential movement during compaction of the rock. Wood described them in 1935 as a result of slipping around a collapsing shell or plant debris.—V.S.N.

2829 **Wood, Albert E.; Konizeski, R. L.** A new eutypomyid rodent from the Arikareean (Miocene) of Montana: Jour. Paleontology, v. 39, no. 3, p. 492–496, illus., 1965.

Four localities northwest of Deer Lodge, Montana, produce Arikareean early Miocene fossils of the Tavenner Ranch Local Fauna. A fifth, with apparently identical lithology, has produced two specimens of Oligocene aspect, one tentatively identified as *Leptomeryx*, which, while predominantly Oligocene, is also Arikareean. *Eutypomys montanensis*, new species, is more advanced than the previously known (Oligocene) members of the family and could readily be Arikareean. The relationships of the Eutypomyidae are discussed. The family is still considered to be more closely related to the beavers than to any other rodents.—Authors' abstract

3239 **Woodrow, Donald Lawrence.** Upper Devonian stratigraphy and sedimentation in Bradford County, Pennsylvania [abs.]: Dissert. Abs., v. 26, no. 6, p. 3253, 1965.

2801 **Wornardt, W. W.** Mechanical finger for preparation of diatom slides, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 283–287, illus., 1965.

The mechanical finger in use at the California Academy of Sciences for mounting individual diatoms is described, and detailed directions for its use are given. This finger has the advantage of clamping onto the microscope stage. Attention is called to two other forms which were described earlier.—E.S.L.

2756 **Wright, H. E.; Cushing, E. J.; Livingstone, D. A.** Coring devices for lake sediments, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 494–520, 1965.

This paper is concerned chiefly with apparatus specifically designed for raising reasonably complete cores from lake and bog sediments for paleontologic investigation. It is emphasized that the key to successful coring is ingenuity in adapting the equipment to field conditions, and in dealing with unexpected problems.

The greater part of the paper is devoted to discussion of types of samplers, divided into hand-driven corers, augers, and heavy coring devices.—E.S.L.

3210 **Wright, H. E., Jr.; Ruhe, R. V.** Glaciation of Minnesota and Iowa, *in* The Quaternary of the United States: Princeton, N. J., Princeton Univ. Press, p. 29–41, illus., table, 1965.

Drifts of all four major glacial stages, and paleosols and sediments of the interglacial stages, occur in the area. Pre-Wisconsin age drifts in Minnesota cannot be traced continuously or correlated easily. In Iowa, however, they are well exposed. Much of the so-called Iowa till may be eroded older till, as implied by C-14 dates, but the problem is not completely solved. Loess was extensively deposited in Iowa from about 29,000 to 20,000 years ago. Wisconsin glaciation in Minnesota involved the interaction of four major ice lobes; only the Des Moines lobe affected Iowa. Five phases of Wisconsin ice advance in Minnesota are described. Glacial Lakes Duluth, Upham, Aitkin, and Agassiz record late stages in ice recession.—E.S.L.

3285 **Wright, H. E., Jr.; Frey, David G.** (editors). The Quaternary of the United States—A review volume for the 7th Congress of the International Association for Quaternary Research: Princeton, N. J., Princeton Univ. Press, 922 p., illus., tables, 1965.

After an introductory chapter on early American studies, the book is arranged in four principal sections—geology, biogeography, archeology, and miscellany. The geologic chapters are arranged on a geographic basis to cover present knowledge of Quaternary history and processes, and give diverse methods of investigating the complex problems presented by surficial sediments. The 16 chapters under biogeography include six on regional phytogeography and palynology. The eight zoogeographic chapters are arranged on a taxonomic basis. Archeology is treated principally in five regional chapters. These emphasize paleoecology, or deal with features that have some geologic context. The miscellaneous chapters that conclude the volume concern such diverse subjects as tectonics, paleomagnetism, isotope geochemistry, and oceanography.—E.S.L.

3185 **Wright, Herbert E., Jr.** Late-glacial vegetation history of the Lake Superior region [abs.], *in* Conf. on Great Lakes Research, 8th, Ann Arbor, 1965, Proc.: Michigan Univ. Great Lakes Research Div. Pub. 13, p. 248, 1965.

Wyllie, P. J. *See* Franz, G. W., 3089

3289 **Yasso, Warren E.** Fluorescent tracer particle determination of the size-velocity relation for foreshore sediment transport, Sandy Hook, New Jersey: Jour. Sed. Petrology, v. 35, no. 4, p. 989–993, illus., 1965.

Four size-classes of foreshore sand, color coded with fluorescent coating material, were introduced at mid-swash line two hours before high tide on Kingmill Beach, Sandy Hook, N. J. Wave height, frequency, and angle of approach to the shore were determined for the 49.7 minute test period following introduction of the marked particles; times of first arrival and peak arrival of tracer particles at a sampling line 30.5 m downdrift from the point of introduction were determined. Only one particle in each of the two larger classes was recovered; first arrival and peak arrival data for the two smaller classes indicated that an inverse size-velocity relationship prevails in beach drift transport.—E.J.C.

Yochelson, Ellis L. *See* Kier, Porter M. 2815

Yochelson, Ellis L. *See* Sohl, Norman F. 2823

Yoder, H. S., Jr. *See* Kullerud, G. 2945

3049 **Young, E. J.; Lovering, T. G.** Jasperoids of the Lake Valley mining district, New Mexico: U.S. Geol. Survey Bull. 1222-D, p. D1–D25, illus., 1966.

An investigation was made of the chemical composition, texture, mineralogy, and appearance of several jasperoid (silicified carbonate rock) bodies, to relate these

characteristics to structure, stratigraphy, lithology, and composition of the host rocks and to proximity of silver and manganese deposits. Jasperoid favorable to association with these ores in Fusselman Dolomite at some distance from known ore bodies in Lake Valley, along with other evidence, suggests that sulfide minerals possibly may be found in this dolomite near the Berenda fault.—V.S.N.

3058 **Young, W. E.; Delicate, D. T.** Mining methods and costs at Section 23 uranium mine, Homestake-Sapin Partners, McKinley County, N. Mex.: U.S. Bur. Mines Inf. Circ. 8280, 48 p., illus., 1965.

The distribution, form, and size of ore bodies in one of the large uranium deposits of the Ambrosia Lake area, N. Mex., are summarized as a frame of reference for describing the mining methods.—A.P.B.

2805 **Zangerl, Rainer.** Radiographic techniques, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 305–320, illus., 1965.

A radiogram is a shadow picture produced on a photograph by X-rays as they are passed through an object. The use of radiographic methods permits almost immediate examination of the fossil content of many slabs of rock. The equipment and exposure techniques are described. Radiographs for exploratory purposes and study of internal structures, and the printing and reading of radiographs are discussed.—E.S.L.

2892 **Zangerl, Rainer.** Galvanoplastic reproduction of fossils, *in* Handbook of paleontological techniques: San Francisco, Calif., W. H. Freeman and Co. (for Paleontological Society), p. 413–420, illus., 1965.

Electroforming (galvanoplastic reproduction) is particularly recommended for fossil specimens that are spread out parallel to the bedding planes or along split faces of concretions. The equipment used at the Chicago Natural History Museum is described. Preparation of a mold to act as a cathode, electroforming in copper, and the problems encountered are discussed.—E.S.L.

3006 **Zeller, Robert A., Jr.; Alper, Allen M.** Geology of the Walnut Wells quadrangle, Hidalgo County, New Mexico: New Mexico Bur. Mines and Mineral Resources Bull. 84, 105 p., illus., tables, geol. map, 1965.

Stratigraphy, structure, and petrography are presented for this area, most of which is in the Animas Mountains. Strongly deformed Paleozoic and Cretaceous sedimentary rocks are overlain by a less deformed thick series of Tertiary volcanic, intrusive, and sedimentary rocks, arched in the east-central part of the quadrangle to give the only exposure of pre-Tertiary rocks. To the north the Oak Creek Tuff is intruded by the Animas quartz-monzonite stock and by the Walnut Wells monzonite-porphyry plug; all three were derived from a common magma, as indicated by similarity of composition and zircon elongations. There is evidence of four periods of deformation, the last one still active. Mineral deposits include manganese, silver, lead, and fluorspar, with only manganese recently produced.—G.D.C.

Zen, E-An. *See* Hanshaw, Bruce B. 3014

3086 **Ziemer, Paul L.; Christian, John E.** Determination of the gross gamma radioactivity of Indiana soils by large volume liquid scintillation counting: Indiana Acad. Sci. Proc. 1964, v. 74, p. 339–342, table, 1965.

The samples studied represent soils submitted from 2,153 farm fields in 63 counties throughout the State. All samples were counted for four minutes. Results are tabulated. The average gross gamma activity for all counties was 4.6 picocuries per gram.—E.S.L.

3116 **Zimmermann, Richard Albert.** The origin of the bedded Arkansas barite deposits (with special reference to the genetic value of sedimentary features in the ore) [abs.]: Dissert. Abs., v. 26, no. 5, p. 2694, 1965.

Zumberge, James H. *See* Wayne, William J. 3246

INDEX

[The numbers refer to entries in the abstracts]

Absolute age, dates
Pleistocene events
Comparison with climatic curve: Broecker, Wallace S. 3305
Sedimentary rocks
Alberta–British Columbia, pebbles in McDougall Segur conglomerate: Norris, D. K. 2920
Sediments
Caribbean Sea, globigerina ooze, Th-230: Ku, Teh-Lung. 2953

Absolute age, methods
Carbon-14
Archaeologic sites: Hole, Frank. 3211
General
Pleistocene events: Broecker, Wallace S. 3305

Alabama
Paleontology
Foraminifera, Eocene, Lisbon Formation: Oman, Carl Henry. 3158
Ostracoda, Oligocene, biostratigraphy: Mumma, Martin Dale. 3294
Protista, Eocene–Oligocene, southwestern, coccoliths as index fossils: Joerger, Arthur Peter. 3292

Alaska
Maps
Geologic, Kateel River quadrangle: Patton, William W., Jr. 3052
Geologic, McCarthy B-5 quadrangle: MacKevett, E. M., Jr. 3043
Glacial, extent of glaciations: U.S. Geological Survey. 2904

Antimony
Genesis
Stibnite deposits: Norton, Denis Locklin. 3232

Appalachians
Geomorphology
Highlands, periglacial features: Richards, Horace G. 3250
Paleontology
Palynology, Pennsylvanian, Allegheny coals, northern coal field: Gray, Lewis Richard. 3280
Sedimentary petrology
Central, Ordovician–Silurian: Horowitz, Daniel Henry. 3131
Structural geology
Folding, episodes: Cloos, Ernst. 2873

Arizona
Absolute age
Santa Catalina Mts., zircons, discordant ages: Catanzaro, Edward John. 3150

Bauxite
Costa Rica
Resources, analyses, lithologic classification, genesis: Castillo M., Rolando. 3025

Beryllium
Colorado
Lake George area, relation to Pikes Peak Granite: Hawley, Charles Caldwell. 3153

Bibliography
Authors
Grawe, Oliver Rudolph: Muilenburg, Garrett A. 3017

Calcite
Geochemistry
Solution and deposition, hydrothermal systems: Holland, H. D. 2947

California
Areal geology
Santa Ynez Mts., western, guidebook: Coast Geological Society. 3259
Economic geology
Mineral resources, offshore: Gaal, Robert. 3005
Geomorphology
Newport Beach area, general, relation to human geography: Loeser, Cornelius James. 3216
Paleontology
Foraminifera, Tertiary, Poppin Shale, Gaviota Alegria Formations, Santa Ynez Mts.: Weaver, Donald W. 3256
Petrology
Sierra Nevada foothills, central, metamorphism migmatization–intrusion: Ehrreich, Albert LeRoy. 3223
Sierra Nevada, potash-rich basalts termed shoshonites: Joplin, Germaine A. 3325
Sedimentary petrology
Miocene rocks, striated polished pebbles, tectonic origin: Clifton, H. Edward. 3196
Stratigraphy
Mono Craters quadrangle, sections: Kistler, Ronald W. 2965
Quaternary: Wahrhaftig, Clyde. 3254

Caribbean region
Maps
Structure: Weyl, Richard. 2871
Structural geology
Orogenesis: Weyl, Richard. 2871

Caribbean Sea
Absolute age
Globigerina ooze, Th-230: Ku, Teh-Lung. 2953

Caves
Detection
California, magnetic surveys over lava tubes: Lange, Arthur L. 3028
Missouri
Saint Louis, Cherokee Cave, highway foundation investigations: Laundrum, J. D. 2877

Cenozoic
Alaska
Kateel River quadrangle, fossil list: Patton, William W., Jr. 3052
Gulf of California
Colorado River delta region, stratigraphy: Merriam, Richard. 3174
Idaho
Oreana quadrangle, Miocene–Recent stratigraphy: Anderson, Norman Roderick. 3125
North America
Western, Pisces, evolution, relation to drainage changes: Smith, Gerald Ray. 3243

Cenozoic
South Carolina
Coastal Plain, central, stratigraphy of terraces: Atlantic Coastal Plain Geol. Assoc. 2922
Virginia
Southeastern, post-Miocene stratigraphy and morphology: Oaks, Robert Quincy, Jr. 3135
Central America
Stratigraphy
Cretaceous–Tertiary paleogeography: Weyl, Richard. 2871
Structural geology
Isthmian linkage and island arcs, orogeny: Rode, K. P. 2938
Orogenesis: Weyl, Richard. 2871
Cephalopoda
Ammonoidea
Mississippian, Kentucky–Indiana: Knapp, William Dale. 3102
Pennsylvanian, Northwest Territories, Hare Fiord Formation: Nassichuk, Walter William. 3108
Daraelitidae
Paleozoic, late, taxonomy: Hodgkinson, Kenneth Allred. 3171
General
Collecting techniques: Flower, Rousseau H. 2824
Prolecanitidae
Paleozoic, late, taxonomy: Hodgkinson, Kenneth Allred. 3171
Changes of level
Gulf Coastal Plain
Quaternary surfaces: Bernard, Hugh A. 3313
Northwest Territories
Quaternary, Baffin Island, north-central: Andrews, J. T. 3080
United States
Quaternary, contiental shelf deposits: Curray, Joseph R. 3283
Chemical analysis
Error detection
Data conversion to rational mineral analyses: Shead, A. C. 2943
Fossils
Preparation: Dodd, James R. 2808
Wet
Technique, copper determination, use of bathocuproine for quantitative: Nowlan, G. A. 3027
Clay mineralogy
Areal studies
Costa Rica, clay deposits, genesis, analyses: Castillo M., Rolando. 3025
Florida–Georgia, Hawthorn and Tampa Formations, attapulgite origin: Gremillion, L. Ray. 3148
Montana–Idaho, Belt Series, layer-silicate diagenesis with depth: Maxwell, Dwight Thomas. 3156
Clay mineralogy
Areal studies
New Mexico, Laguna, altered sandstone pipes: Megrue, George H. 3012
North Carolina, Cape Fear River area, basal Cretaceous beds: Atlantic Coastal Plain Geol. Assoc. 2982
Oklahoma, Trinity Group, zones: Manley, Frederick Harrison, Jr. 3155
Experimental studies
Adsorption, mutual with chromium oxide: Shaw, Don Wayne. 3091
Clay–water systems, ion diffusion: VanSchaik, Jacob Cornelis. 3123
Clay–water systems, resistivity, pressure effects: Lang, William Joseph. 3103
Colorado
Maps
Aeromagnetic, Denver area: Petty, A. J. 2970
Geologic, Cerro Summit quadrangle: Dickinson, Robert G. 2856
Paleoclimatology
Western, paleosols, interpretation: Power, Peter Edward. 3110
Paleontology
Fauna, Mesozoic, Cerro Summit quadrangle, zones: Dickinson, Robert G. 2856
Insecta, Oligocene, Antero Formation, Park County: Durden, Christopher J. 3083
Petrology
Lake George area, Pikes Peak Granite: Hawley, Charles Caldwell. 3153
Sedimentary petrology
Huerfano Park, Tertiary formations, heavy mineral fractions: Briggs, Louis I. 3175
Stratigraphy
Cerro Summit quadrangle, sections: Dickinson, Robert G. 2856
Quaternary, Piedmont, nonglacial: Scott, Glenn R. 3253
Quaternary, Ridgway Till, Ouray County, Pleistocene not Eocene age: Mather, Kirtley F. 3016
Tertiary, Antero Formation and Florissant beds, Park County: Durden, Christopher J. 3083
Colorado Plateau
Stratigraphy
Quaternary: Kottlowski, Frank E. 3312
Concretions
Coal balls
Collecting: Mamay, S. H. 2886
Paleontology
Collecting techniques: Kauffman, Erle G. 2782
Connecticut
Economic geology
Gravel, Voluntown quadrangle: Feininger, Tomas. 2831
Glacial geology
Voluntown quadrangle, history and deposits: Feininger, Tomas. 2831
Maps
Aeromagnetic, Ashaway and Watch Hill quadrangles: Boynton, G. R. 3269

Connecticut
Maps
Aeromagnetic, Jewett City quadrangle: Boynton, G. R. 3261
Aeromagnetic, Norwich quadrangle: Boynton, G. R. 3265
Aeromagnetic, Old Mystic and Mystic quadrangles: Boynton, G. R. 3266
Aeromagnetic, Oneco quadrangle: Boynton, G. R. 3264
Aeromagnetic, Plainfield quadrangle: Boynton, G. R. 3263
Aeromagnetic, Scotland quadrangle: Boynton, G. R. 3262
Aeromagnetic, Uncasville and New London quadrangles: Boynton, G. R. 3268
Aeromagnetic, Voluntown quadrangle: Boynton, G. R. 3267
Geologic, Plainfield quadrangle, bedrock: Dixon, H. Roberta. 2834
Surficial geology, Voluntown quadrangle: Feininger, Tomas. 2831
Surficial geology, Watch Hill quadrangle: Schafer, J. P. 2833
Stratigraphy
Plainfield quadrangle, section: Dixon, H. Roberta. 2834
Conodonts
General
Collecting techniques: Collinson, Charles. 2887
Preparation techniques, magnetic separation: Dow, Verne E. 2796
Mississippian
Kansas, Meramecian strata: Thompson, Thomas Luther. 3114
Ordovician
New York–Ontario–Quebec, Trenton Group: Schopf, Thomas Joseph Morton. 3031
Construction materials
Properties
Aggregates, degradation on highways, processes, factors, research: West, T. R. 2879
Aggregates, petrographic evaluation: Lounsbury, R. W. 2878
Continental drift
Crustal structure
Central America, Isthmian linkage and island arc system: Rode, K. P. 2938
Reconstruction
Numerical method, fit of continents around Atlantic: Bullard, Edward. 3067
Continental shelf
United States
Quaternary deposits: Curray, Joseph R. 3283
Continental slope
General
Origin, data of acoustical surveys: Terry, Richard Dean. 3236
Copper
Alaska
Brooks Range, Ruby Creek deposit: Runnells, Donald DeMar. 3234
Copper
Analysis
Chemical, quantitative, use of bathocuproine: Nowlan, G. A. 3027
Exploration
Disseminated deposits, weathered outcrops, characteristics: Durek, Joseph John. 3147
Costa Rica
Areal geology
General: Dondoli B., Cesar. 2870
Economic geology
Clays and bauxitic laterites, lithologic classification, genesis, analyses: Castillo M., Rolando. 3025
Gold, lode and placer deposits, and other resources: Dondoli B., Cesar. 2870
Cretaceous
Oklahoma
Choctaw County, Annelida, Caddo Limestone: Branson, Carl C. 2912
Southern, Trinity Group, depositional history: Manley, Frederick Harrison, Jr. 3155
Tennessee
Stratigraphy below McNairy Sand: Russell, Ernest Everett. 3137
Texas
Southeastern, stratigraphy: Halbouty, Michel T. 2974
United States
Midcontinent, gravels and fossils: Owen, D. E. 3118
Wyoming
Northern, Lower, stratigraphy and palynology: Davis, Phillip Nixon. 3127
Crust
Central America
Isthmian linkage and island arcs, orogenesis: Rode, K. P. 2938
General
Seismic exploration, reflection technique: Dix, C. H. 2869
Manitoba
Conrad and M-discontinuities: Hall, D. H. 2850
Cryptoexplosion structures
General
Exogenic and endogenic causes: Kugler, H. G. 3320
Crystal chemistry
Spinel solid-solution series
Oxidation–reduction reactions and equilibria: Ulmer, Gene Carlton. 3215
Crystal structure
Asbestos
General: Gaze, Richard. 3274
Feldspars: Taylor, W. H. 3061
Mica
Polytypes: Ross, Malcolm. 2994
Minerals
Textbook: Bragg, Lawrence. 3062
Orthoclase
Comparative in igneous rocks: Longshore, Judith Clark. 2989

Crystal structure
Pyroxene
Greenland, Kap Edvard Holm complex: Deer, W. A. 3323
Weddellite
Marine sediments, modern: Hutton, C. Osborne. 3324
Crystallography
Crystal growth
Metal monoxide,properties:Berkebile, Charles Alan. 3240
Deformation
Experimental studies
Mine pillars, salt, trona, potash models: Obert, Leonard. 2830
Precambrian rocks
Greenland, Ilordleq area, episodes: Watterson, Juan. 3018
Deltas
Gulf of California
Colorado River, stratigraphy: Merriam, Richard. 3174
Structure
Experimental study, shape of laminae: Jopling, Alan V. 3190
Devonian
Alberta
Mount MacKenzie area, Fairholme Group and Sassenach Formation: MacKenzie, W. S. 3070
Northeastern, stratigraphy and paleoecology: Loranger, D. M. 3193
Iowa
Iowa City area, Stromatoporoidea: Pestana, Harold Richard. 3109
New York
Catskill Mts., flora: Matten, Lawrence Charles. 3214
North America
Anthozoa, tetracorals, *Smithiphyllum* emended: Pedder, A. E. H. 2958
Oklahoma
Northeastern, stratigraphy, guidebook: Kansas Geological Society. 3076
Pennsylvania
Bradford County, Upper, stratigraphy: Woodrow, Donald Lawrence. 3239
Diagenesis
Limestone
Oolites, strontium loss: Kahle, Charles F. 3194
Sedimentary rocks
Cementation: Warner, Mont M. 3192
Diatoms
General
Preparation techniques, slides, mechanical finger: Wornardt, W. W. 2801
Dikes
Greenland
Ilordleq area, mafic, significance: Watterson, Juan. 3018
Julianehab district, net-veined, mechanism: Windley, B. F. 2941
Dolomite
Tennessee
Morristown quadrangle, resources: Swingle, George D. 3045
Drainage changes
United States
Great Plains, northern, Quaternary: Lemke, R. W. 3244
Dunes
Materials
Atlantic Coastal Plain, southern: Giles, Robert T. 3173
Earth
Free oscillations
Alaskan earthquakes, 1964, Czechoslovakian records: Wirth, Hans. 3079
Engineering geology
Highways
South Dakota, eastern, foundation problems in glacial deposits: Grimes, Walter W. 3026
Materials, properties
Aggregates, degradation on highways, processes, factors, research: West, T. R. 2879
Aggregates, petrographic evaluation: Lounsbury, R. W. 2878
Volcanic rocks, hydrologic analysis, laboratory methods: Johnson, Arnold I. 2932
Glacial geology
United States
Quaternary, review: Wright, H. E., Jr. 3285
Washington
Columbia Plateau: Richmond, Gerald M. 3300
History, Pleistocene ice advances: Crandell, Dwight R. 3255
Wisconsin
General: Frye, John C. 3245
Glacial lakes
New England
History: Schafer, J. P. 3249
New York
Mohawk–Hudson River valleys: LaFleur, Robert G. 3036
Rocky Mountains
Northern: Richmond, Gerald M. 3300
Washington
Columbia Plateau: Richmond, Gerald M. 3300
Great Lakes region
Paleontology
Palynology, Quaternary, interpretation from modern: Cushing, Edward J. 3311
Sedimentary petrology
Lake Michigan, Manitou Passage, sedimentation: French, William Edwin. 3100
Lake Michigan, southeastern, nearshore sedimentation: Davis, Richard Albert, Jr. 3128
Stratigraphy
Quaternary, Lakes Erie and Ontario area: Goldthwait, Richard P. 3247

Greenland
Maps
Geologic, eastern, Kangerdlugssuaq intrusion: Wager, L. R. 3330
Geologic, Sermiligarssuk–Igaliko Fjord area: Watterson, Juan. 3018
Petrology
Eastern, Kap Edvard Holm complex, upper and lower series: Deer, W. A. 3323
Ilordleq area, plutonic development: Watterson, Juan. 3018
Julianehab district, net-veined diorite intrusives: Windley, B. F. 2941
Structural geology
Eastern, Kangerdlugssuaq intrusion: Wager, L. R. 3330
Ilordleq area, deformations: Watterson, Juan. 3018
Julianehab district, net-veined diorite intrusives: Windley, B. F. 2941
Ground water
Arizona
Composition, Willcox basin, fluoride content and salinity: Kister, L. R. 3087
Hawaii
Discharge, Oahu; Waihee Valley, use of tunnels: Hirashima, George T. 2997
Indiana
Resources, West Lafayette area, Homewood subdivision: West, Terry R. 3084
Kentucky
Resources, Hamlin and Paris Landing quadrangles: Lambert, T. W. 3088
Louisiana
Quality from electrical logs, southwestern: Whitman, Harry M. 3029
Mississippi
Resources, Clay, Lowndes, Monroe, Oktibbeha Counties: Wasson, B. E. 2995
Nevada
Resources, Humboldt River valley near Winnemucca: Cohen, Philip. 2866
New Mexico
Levels, 1964: Busch, Fred E. 3077
Resources, Three Rivers area: Hood, James W. 2906
Texas
Resources and quality, Camp, Franklin, Morris, Titus Counties: Broom, M. E. 2992
Resources, Jackson County: Baker, E. T., Jr. 3030
Guatemala
Areal geology
Esquipulas–Chanmagua–Cerro Montecristo quadrangles: Burkart, Burke. 3095
Petrology
Baja Verapaz, pumice, fresh and reworked: Rode, K. 3021
Stratigraphy
Jocotan and Timushan quadrangles, Cretaceous Tertiary: Crane, David Clinton. 3099
Structural geology
Baja Verapaz, basins: Rode, K. 3021
Jocotan and Timushan quadrangles: Crane, David Clinton. 3099
Gulf Coastal Plain
Geomorphology
Northwestern coastal area, Quaternary features: Bernard, Hugh A. 3313
Paleontology
Cretaceous, collecting in unconsolidated sediments, techniques: Sohl, Norman F. 2779
Gastropoda, Eocene, turritellas, classification: Allison, Richard C. 2959
Nannofossils, Cretaceous, northwestern: Gartner, Stefan, Jr. 3279
Sedimentary petrology
Louisiana and Arkansas, Cotton Valley Group, depositional environments: Thomas, William A. 2949
Stratigraphy
Jurassic, Cotton Valley Group, Louisiana–Arkansas, Upper: Thomas, William A. 2949
Quaternary, northwestern area: Bernard, Hugh A. 3313
Gulf of California
Sedimentary petrology
Colorado delta, mudflats: Thompson, Robert Wayne. 3139
Colorado River delta sediments, provenance: Merriam, Richard. 3174
Stratigraphy
Cenozoic, Colorado River delta region: Merriam, Richard. 3174
Gulf of Mexico
Paleontology
Foraminifera, Oligocene–Miocene, *Miogypsina*: Barker, R. Wright. 2936
Hawaii
Geophysical surveys
Hawaiian Ridge, magnetic: Malahoff, Alexander. 3229
Hydrogeology
Oahu, Waihee Valley, ground-water discharge, use of tunnels: Hirashima, George T. 2997
Petrology
Basalts, hypersthene-bearing, pyroxene relations: Muir, I. D. 3326
Kilauea volcano, 1959–60 lavas, differentiation: Richter, D. H. 3164
Volcanology
Kilauea, infrared photography, structure interpretation: Fischer, William A. 3276
Weathering
Soils, Mauna Kea ash: Houng, Kun-Huang. 3213
Heavy minerals
Atlantic Coastal Plain
Southern, dune, beach, and river sands: Giles, Robert T. 3173
Colorado
Huerfano Park, Tertiary formations, provenance: Briggs, Louis I. 3175

Hydrogeology
Aquifer properties
Laboratory analysis, methods: Johnson, Arnold I. 2932
Climatic changes
Effects of Quaternary: Schumm, S. A. 3203
Experimental studies
Soils, hydraulic conductivity, field method: Stibbe, Ehud. 3160
Hydrothermal alteration
Argillic
New Mexico, breccia pipes: Megrue, George H. 3012
Idaho
Geophysical surveys
National Reactor Testing Station area, radioactivity, airborne: Bates, Robert G. 3321
Hydrogeology
Arco area, Snake River basalt, properties, laboratory analysis: Johnson, Arnold I. 2932
Maps
Geologic and gravity, Snake River Plain: Malde, Harold E. 3316
Geologic, Doublespring quadrangle: Mapel, W. J. 2855
Radioactivity, National Reactor Testing Station area, airborne: Bates, Robert G. 3321
Mineralogy
Plagioclase, Rock Creek basalt flow, variations: Hoffer, Jerry Martin. 3227
Petrology
Belt Series, diagenetic-metamorphic trends, layer silicates: Maxwell, Dwight Thomas. 3156
Columbia River basalt, Rock Creek flow: Hoffer, Jerry Martin. 3227
Stratigraphy
Cenozoic, Oreana quadrangle, Miocene-Recent: Anderson, Norman Roderick. 3125
Doublespring quadrangle, sections: Mapel, W. J. 2855
Quaternary, early-middle Pleistocene, Snake River Plain: Malde, Harold E. 3316
Structural geology
Snake River Plain: Malde, Harold E. 3316
Volcanology
Snake River Plain, eastern: Malde, Harold E. 3316
Igneous rocks
Basalt
Composition, high-alumina type in deep-ocean localities: Nicholls, G. D. 3327
Composition, oceanic and circumoceanic: Chayes, Felix. 3287
Composition, potash-rich, termed shoshonite not latite: Joplin, Germaine A. 3325
Composition, pyroxene relations in hypersthene bearing, Hawaii: Muir, I. D. 3326
Composition, W-1, analyses since 1962: Fleischer, Michael. 2858
Igneous rocks
Basalt
Crystallization, Idaho, Columbia River basalt, Rock Creek flow: Hoffer, Jerry Martin. 3227
Geochemistry, petrogenetic significance of Pd content: Crocket, James H. 3090
Petrology, New York, Stark's Knob: Hewitt, P. C. 3033
Carbonatite
Petrogenetic relations with kimberlite: Franz, G. W. 3089
Geochemistry, origin: Watkinson, David Hugh. 3241
Classification
Potash-rich basaltic rock, termed shoshonite not latite: Joplin, Germaine A. 3325
Potassic-feldspathic associated with carbonatites, nomenclature: Sutherland, D. S. 2984
Differentiation
Hawaii, Kilauea eruption 1959-60: Richter, D. H. 3164
Trends, melilite, soda content: Edgar, A. D. 2828
Granite
Composition, G-1, analyses since 1962: Fleischer, Michael. 2858
Geochemistry, chemical and radiometric study: Stow, Stephen H. 2991
Petrology, Greenland, Ilordleq area: Watterson, Juan. 3018
Composition, Mono Craters quadrangle, Calif., modal analyses: Kistler, Ronald W. 2965
Weathering, geochemical and mineralogic studies: Harriss, Robert Curtis. 3101
Ignimbrite
Petrology, Nevada, Grant Range: Scott, Robert Blackburn, 3d. 3112
Kimberlite
Experimental studies: Franz, Gilbert Wayne. 3142
Petrogenetic relations with carbonatite: Franz, G. W. 3089
Potassic-feldspathic
Nomenclature and classification for rock associated with carbonatites: Sutherland, D. S. 2984
Pumice
Petrology, Guatemala, Baja Verapaz basins: Rode, K. 3021
Ultramafic
Geochemistry and petrology, genetic relationships: Stueber, Alan Michael. 3113
Volcanics
Petrology, New Mexico, Walnut Wells quadrangle: Zeller, Robert A., Jr. 3006
Physical properties, hydrologic analysis, laboratory methods: Johnson, Arnold I. 2932

Illinois
General
Geology applied to land use, Chicago metropolitan area: Hackett, James E. 3064
Geophysical surveys
Northeastern, seismic and gravity, crustal structure: McGinnis, Lyle David. 3106
Glacial geology
General: Frye, John C. 3245
Paleontology
Pteridophytes, Pennsylvanian, Carbondale Formation, Carterville area: Hibbert, F. A. 2960
Worms, Pennsylvanian, Francis Creek shale: Richardson, E. S., Jr. 2955
Stratigraphy
Quaternary, general: Frye, John C. 3245
Rock Island area, test well: Buschbach, T. C. 2998
Structural geology
Northeastern, crustal movements: McGinnis, Lyle David. 3106
Rock Island area: Buschbach, T. C. 2998
Inclusions
Basalt
Ultramafic and mafic, composition: Carter, James Lee. 3097
Indiana
Geomorphology
Monroe County, western, karst valley, development: Powell, Richard L. 3119
Geophysical surveys
Radioactivity, soils: Ziemer, Paul L. 3086
Glacial geology
Central, Cartersburg till, end moraines: Wayne, William J. 3120
General: Wayne, William J. 3246
Hydrogeology
West Lafayette area, Homewood subdivision, glacial deposits: West, Terry R. 3084
Paleontology
Cephalopoda, Mississippian, Ste. Genevieve Limestone, Greencastle area: Knapp, William Dale. 3102
Stratigraphy
Quaternary, general: Wayne, William J. 3246
Infrared surveys
Hawaii
Kilauea volcano: Fischer, William A. 3276
Insecta
Quaternary
United States, Pleistocene dispersals: Ross, Herbert H. 3306
Tertiary
Colorado, Antero Formation, Park County, new locality: Durden, Christopher J. 3083
Intrusions
Sills
Virginia, Old Dominion area, soapstone deposits, petrology: Greenberg, S. S. 3069
Structure
Greenland, eastern Kangerdlugssuaq intrusion: Wager, L. R. 3330
Intrusions
Structure
New Mexico, Walnut Wells quadrangle: Zeller, Robert A., Jr. 3006
Invertebrata
Cenozoic
Alaska, Kateel River quadrangle, list: Patton, William W., Jr. 3052
Mesozoic
Alaska, Kateel River quadrangle, list: Patton, William W., Jr. 3052
Quaternary
North America, biogeography: Frey, David G. 3304
Iowa
Geomorphology
Mississippi–Missouri interfluve, landform characteristics, runoff: Hidore, John J. 2944
Glacial geology
General: Wright, H. E., Jr. 3210
Paleontology
Mollusca, Ordovician, Maquoketa Shale, Graf area, *Septemchiton*: Sanders, Robert B. 2942
Stromatoporoidea, Devonian, Cedar Valley Limestone, Iowa City area: Pestana, Harold Richard. 3109
Stratigraphy
Quaternary, Pleistocene drifts: Wright, H. E., Jr. 3210
Silurian–Devonian, northeastern, guidebook: Geological Society of Iowa. 3187
Iron
Geochemistry
Sedimentary rock occurrences: James, Harold L. 3074
Tennessee
Morristown quadrangle, resources: Swingle, George D. 3045
Isotopes
Krypton
Meteorites, Bruderheim: Merrihue, Craig. 3053
Xenon
Meteorites, Bruderheim: Merrihue, Craig. 3053
Jurassic
Gulf Coastal Plain
Louisiana–Arkansas, Cotton Valley Group: Thomas, William A. 2949
Texas
Southeastern, stratigraphy, Upper: Halbouty, Michel T. 2974
Kansas
Economic geology
Petroleum and natural gas, Brehm field, exploration: Bird, W. E. 2848
Geophysical surveys
Brehm oil and gas field, seismic: Bird, W. E. 2848
Glacial geology
General: Reed, E. C. 3251

Kansas
Paleontology
Conodonts, Mississippian, Meramecian strata: Thompson, Thomas Luther. 3114
Vertebrata, Pleistocene, McPherson Formation, *Equus* beds: Semken, Holmes Alford, Jr. 3235
Sedimentary petrology
Reagan Sandstone: McElroy, Marcus Nelson. 3230
Stratigraphy
Cambrian, Reagan Sandstone, western: McElroy, Marcus Nelson. 3230
Quaternary: Reed, E. C. 3251
Quaternary, Meade and Sanborn Groups, McPherson County: Semken, Holmes Alford, Jr. 3235

Karst
Indiana
Monroe County, western, underground valley, development: Powell, Richard L. 3119
Kentucky
South-central, analysis: LaValle, Placido D. 3295

Kentucky
Economic geology
Clays, fuller's earth resources, Jackson Purchase region: McGrain, Preston. 3000
Limestone, Jabez quadrangle: Thaden, Robert E. 3281
Limestone, Kirksville quadrangle: Greene, Robert C. 2862
Limestone, Richmond South quadrangle: Greene, Robert C. 2963
Mineral resources, Sharon Grove quadrangle: Ulrich, George E. 3075
Petroleum and gravel, Phil quadrangle: Maxwell, Charles H. 3023
Petroleum and limestone, Sonora quadrangle: Moore, Frank B. 2840
Petroleum and natural gas, Stricklett quadrangle: Morris, Robert H. 2864
Petroleum, coal, limestone, Cumberland City quadrangle: Lewis, Richard Q., Sr. 2861
Geomorphology
South-central, karst topography, analysis: LaValle, Placido D. 3295
Hydrogeology
Hamlin and Paris Landing quadrangles, aquifers: Lambert, T. W. 3088
Maps
Geologic, Cumberland City quadrangle: Lewis, Richard Q., Sr. 2861
Geologic, Jabez quadrangle: Thaden, Robert E. 3281
Geologic, Kirksville quadrangle: Greene, Robert C. 2862
Geologic, Phil quadrangle: Maxwell, Charles H. 3023
Geologic, Richmond South quadrangle: Greene, Robert C. 2963
Geologic, Sharon Grove quadrangle: Ulrich, George E. 3075

Kentucky
Maps
Geologic, Sonora quadrangle: Moore, Frank B. 2840
Geologic, Stricklett quadrangle: Morris, Robert H. 2864
Ground water, Hamlin and Paris Landing quadrangles: Lambert, T. W. 3088
Paleontology
Cephalopoda, Mississippian, New Providence Formation, northern, ammonoids: Knapp, William Dale. 3102
Stratigraphy
Cumberland City quadrangle, section: Lewis, Richard Q., Sr. 2861
Jabez quadrangle, section: Thaden, Robert E. 3281
Kirksville quadrangle, section: Greene, Robert C. 2862
Phil quadrangle, section: Maxwell, Charles H. 3023
Richmond South quadrangle, section: Greene, Robert C. 2963
Sharon Grove quadrangle, section: Ulrich, George E. 3075
Sonora quadrangle, section: Moore, Frank B. 2840
Stricklett quadrangle, section: Morris, Robert H. 2864

Lake Superior region
Maps
Aeromagnetic, western: Kirby, J. R. 2968
Paleontology
Palynology, Quaternary, late-glacial history: Wright, Herbert E., Jr. 3185

Lakes
Lake Michigan
Southeastern, nearshore topography and sediment distribution, stability: Davis, Richard A., Jr. 3181
Sedimentation
Lake Michigan, nearshore environment: Davis, Richard Albert, Jr. 3128

Lakes, extinct
Nevada
Lahontan, history: Morrison, Roger B. 3301
Utah
Bonneville, history: Morrison, Roger B. 3301

Landforms
Interfluvial
Characteristics, effect on runoff: Hidore, John J. 2944

Landslides
Colorado
Ouray County, Pleistocene: Mather, Kirtley F. 3016
Kentucky
Stricklett quadrangle: Morris, Robert H. 2864

Laterites
Genesis
Costa Rica, volcanism and weathering: Castillo M., Rolando. 3025

Lead
Missouri
Southeastern, exploration in Bonneterre Dolomite: Henshaw, Paul C. 3002
Limestone
Kentucky
Cumberland City quadrangle, resources: Lewis, Richard Q., Sr. 2861
Jabez quadrangle, resources: Thaden, Robert E. 3281
Kirksville quadrangle, resources: Greene, Robert C. 2862
Richmond South quadrangle, resources: Greene, Robert C. 2963
Sonora quadrangle, resources: Moore, Frank B. 2840
Tennessee
Morristown quadrangle, resources: Swingle, George D. 3045
Louisiana
Hydrogeology
Southwestern, ground-water quality from electrical logs: Whitman, Harry M. 3029
Sedimentary petrology
Southern, Neogene subsurface rocks, lithosomes: Watson, Stuart T. 3238
Stratigraphy
Tertiary, southern, Neogene subsurface, lithosomes: Watson, Stuart T. 3238
Magmas
Differentiation
Basalt, inclusions, analysis: Carter, James Lee. 3097
Hawaii, Kilauea eruption 1959-60: Richter, D. H. 3164
Reactivation
Greenland, Julianehab district, rheomorphism at depth: Windley, B. F. 2941
Magnetic exploration
Interpretation
Vertical intensity, correlated with horizontal gravity gradient: Thyssen-Bornemisza, Stephen. 2845
Magnetic surveys
California
Northern, Tickner, Danger Skull Caves: Lange, Arthur L. 3028
Hawaii
Hawaiian Ridge: Malahoff, Alexander. 3229
Maine
Geomorphology
Gulf of Maine, Northeast Channel, evolution: Uchupi, Elazar. 2977
Major-element analyses
Amphibolite
Ontario, Chandos township: Shaw, D. M. 3328
Basalt
Deep-ocean tholeiitic and high-alumina types: Nicholls, G. D. 3327
Clays and bauxitic laterites
Costa Rica, chemical and spectrographic: Castillo M., Rolando. 3025
Major-element analyses
Ground water
Mississippi, Clay, Lowndes, Monroe, Oktibbeha Counties: Wasson, B. E. 2995
Olivine
Electron microprobe technique: Smith, J. V. 3329
Pyroxene
Greenland, eastern, Kap Edvard Holm complex: Deer, W. A. 3323
Shoshonite
Yellowstone Park and Sierra Nevada, cf. Australian series: Joplin, Germaine A. 3325
Mammalia
Castoroides ohioensis
Quaternary, North America, Pleistocene range, cranial morphology: Stirton, R. A. 2935
Eutypomys montanensis, n. sp.
Tertiary, Montana, Arikareean, Miocene: Wood, Albert E. 2829
Ictidopappus
Tertiary, systematics: MacIntyre, Giles Ternan. 3242
Protictis
Tertiary, systematics: MacIntyre, Giles Ternan. 3242
Quaternary
Nebraska, Pleistocene, terrace deposits: Reed, E. C. 3251
North America range, stratigraphic and geographic: Hibbard, C. W. 3335
Rodentia
Tertiary, Montana, Tavenner Ranch local fauna, eutypomyids: Wood, Albert E. 2829
Tertiary
Wyoming, Lysite Member of Wind River Formation, Eocene: Guthrie, Daniel Albert. 3293
Man, fossil
General
Dating of sites: Hole, Frank. 3211
Quaternary
New York and northeastern U.S., artifacts, relation to glacial geology: Ritchie, William A. 3212
United States, Great Plains, sites and artifacts: Stephenson, Robert L. 3314
United States, northeastern, fluted points evidence: Griffin, James B. 3318
United States, Pacific Coast: Meighan, Clement W. 3209
United States, southeastern, distribution from fluted points: Williams, Stephen. 3286
Manganese
Abundance
Nodules, deep-sea, distribution and rate of accumulation: Bender, M. L. 2957
Genesis
Sedimentary deposits: Alexandrov, Eugene Alexander. 3094
New Mexico
Lake Valley district, possible new ore bodies: Young, E. J. 3049

Manganese
New Mexico
Walnut Wells quadrangle: Zeller, Robert A., Jr. 3006
Manitoba
Geophysical surveys
Flin Flon–Mafeking, seismic, crustal structure: Hall, D. H. 2850
Maps
Aeromagnetic, Allbright area: Canada Geological Survey. 3365
Aeromagnetic, Armstrong Lake area: Canada Geological Survey. 3363
Aeromagnetic, Arnot area: Canada Geological Survey. 3364
Aeromagnetic, Bearhead Lake area: Canada Geological Survey. 3367
Aeromagnetic, Begg Lake area: Canada Geological Survey. 3360
Aeromagnetic, Bulger Lake area: Canada Geological Survey. 3357
Aeromagnetic, Butterfly Lake area: Canada Geological Survey. 3354
Aeromagnetic, Cotton Lake area: Canada Geological Survey. 3361
Aeromagnetic, Cuddle Lake area: Canada Geological Survey. 3370
Aeromagnetic, Dobbs Lake area: Canada Geological Survey. 3369
Aeromagnetic, Goulet Lake area: Canada Geological Survey. 3366
Aeromagnetic, Gunn Lake area: Canada Geological Survey. 3368
Aeromagnetic, Hawes Lake area: Canada Geological Survey. 3380
Aeromagnetic, High Hill Lake area: Canada Geological Survey. 3371
Aeromagnetic, Landing Lake area: Canada Geological Survey. 3358
Aeromagnetic, Parker Lake area: Canada Geological Survey. 3377
Aeromagnetic, Pikwitonei area: Canada Geological Survey. 3359
Aeromagnetic, Prudhomme Lake area: Canada Geological Survey. 3362
Aeromagnetic, Schwatka Lake area: Canada Geological Survey. 3374
Aeromagnetic, Semmens Lake area: Canada Geological Survey. 3381
Aeromagnetic, Sheet 63 I/C11: Canada Geological Survey. 3355
Aeromagnetic, Sheet 53 M/A11: Canada Geological Survey. 3375
Aeromagnetic, Sheet 53 M/14: Canada Geological Survey. 3376
Aeromagnetic, Sheet 53 M/G7: Canada Geological Survey. 3378
Aeromagnetic, Sheet 53 M/ 10: Canada Geological Survey. 3379
Aeromagnetic, Sheet 53 M/16: Canada Geological Survey. 3384
Aeromagnetic, Stupart Lake area: Canada Geological Survey. 3383
Aeromagnetic, War Lake area: Canada Geological Survey. 3372
Manitoba
Maps
Aeromagnetic, Whitemud Lake area: Canada Geological Survey. 3373
Aeromagnetic, Whiterabbit Lake area: Canada Geological Survey. 3356
Aeromagnetic, Wilsie Lake area: Canada Geological Survey. 3382
Oil and gas, fields and discoveries, western: MacLean, Brian. 2908
Structural geology
Flin Flon–Mafeking, crust, seismic data: Hall, D. H. 2850
Mantle
Elastic properties
Viscosity–anelasticity, interface as locus of earthquake foci: Anderson, D. L. 2954
Temperature
Experimental studies, electrical conductivity of periclase and olivine: Hamilton, Robert Morrison. 3151
Massachusetts
Maps
Geologic, Duxbury quadrangle: Chute, Newton E. 2838
Geologic, Scituate quadrangle: Chute, Newton E. 2837
Mesozoic
Alaska
Kateel River quadrangle, fossil list: Patton, William W., Jr. 3052
Colorado
Cerro Summit quadrangle, faunal zones: Dickinson, Robert G. 2856
Oregon
Southwestern, stratigraphy and tectonics: Koch, John G. 2975
Metals
Alaska
Richardson area, possibilities, geochemical prospecting: Saunders, Robert H. 2918
Slana district, possibilities, geochemical prospecting: Richter, D. H. 2917
Genesis
Base, ore transport mechanism: Barnes, H. L. 2929
Metamorphic rocks
Amphibolite
Classification, use of discriminant function: Shaw, D. M. 3328
General
Paleontology, collecting techniques: Neuman, Robert B. 2780
Petrogenesis, mineralogical–chemical aspects, textbook: Winkler, Helmut G. F. 2919
Gneiss
Petrology, garnet isograds in Adirondack: Buddington, A. F. 3322
Metamorphism
P–T conditions
Garnet isograds on Adirondack gneisses: Buddington, A. F. 3322

Meteorites
Bruderheim
Xenon and krypton, isotopes: Merrihue, Craig. 3053
Composition
Hydrocarbons: Urey, Harold C. 2993
Microstructures
Alais and Orgeuil, organic origin: VanLandingham, Sam L. 2857
Mexico
Geochemistry
Zacatecas, Providencia mining area, sphalerite, fluid inclusions: Sawkins, F. J. 2925
Mineralogy
Sphalerite, Zacatecas, Providencia area, fluid inclusions and zoning: Sawkins, F. J. 2925
Zacatecas, Providencia mining area, paragenesis and inclusions: Sawkins, F. J. 2924
Paleontology
Foraminifera and Ostracoda, Recent, Baja California, Todos Santos Bay: Kaesler, Roger LeRoy. 3228
Ostracoda, Recent, Campeche, Laguna de Terminos: Morales Frias, Gustavo Adolfo. 3231
Pelecypoda, Cretaceous, Baja California, Punta Banda, lamellibranch: Damestoy, Guy. 3189
Petrology
Zacatecas, Providencia mining area, fluid inclusions and orogenesis: Sawkins, F. J. 2924
Michigan
Geomorphology
Lake Michigan, offshore bars and troughs, stability: Davis, Richard A., Jr. 3181
Glacial geology
General: Wayne, William J. 3246
Petrology
Palmer area, Negaunee Formation: Davis, James Frazier. 3222
Sedimentary petrology
Lake Michigan, nearshore areas, sediment distribution stability: Davis, Richard A., Jr. 3181
Stratigraphy
Quaternary, general: Wayne, William J. 3246
Silurian, Michigan basin, reefs: Felber, Bernhard E. 3224
Micropaleontology
Cretaceous
Gulf Coastal Plain, northwestern, nannofossils: Gartner, Stefan, Jr. 3279
Methods
Nannofossils, collecting and sample preparation: Hay, William W. 2895
Photography
Techniques: Benson, Richard H. 2813
Preparations
Diatoms, slides, mechanical finger: Wornardt, W. W. 2801
Micropaleontology
Preparations
Electron microscope, limestones: Honjo, Susumu. 2882
Foraminifera, internal structures, electron microscopy: Krinsley, David. 2883
Foraminifera, techniques for smaller: Todd, Ruth. 2896
Individual specimens, cellulose acetate glue: Martinsson, Anders. 2792
Insoluble residues: Schopf, James M. 2804
Mechanical, Ro-Tap oscillator: Koenig, John W. 2889
Radiolaria in indurated tuff: Burma, Benjamin H. 2771
Sectioning, impregnating, vacuum oven: Arnold, Zack M. 2795
Sectioning, precision grinder: Arnold, Zach M. 2789
Vacuum-needle pick: Stinemeyer, E. H. 2800
Vertebrata, washing and screening: McKenna, Malcolm C. 2784
X-ray microscopy, internal structures: Hooper, Kenneth. 2881
Sampling
Foraminifera, techniques for smaller: Todd, Ruth. 2896
Microscope techniques
Paleontology
Morphologic studies, X-ray: Hooper, Kenneth. 2881
Thin sections, and peels: Honjo, Susumu. 2791
Photography
Palynomorphs: Samuelsson, K. E. 2761
Thin sections: Douglass, Raymond C. 2814
Microseisms
Wave structure
Energy-equipartition mixture: Seriff, A. J. 2841
Standing-wave phenomena: Gupta, Indra N 2842
Mineral deposits, genesis
Antimony
Stibnite: Norton, Denis Locklin. 3232
Barite
Arkansas, bedded deposits: Zimmermann, Richard Albert. 3116
Evaporites
Phase relations, hydrous Ca-Na sulfate system: Hardie, Lawrence Alexander. 3226
Manganese
Sedimentary: Alexandrov, Eugene Alexander. 3094
Molybdenum
Molybdenite deposition: Renault, Jacques Roland. 3111
Ore transport
Mechanisms, environmental limitations: Barnes, H. L. 2929
Ore-forming fluids
Lead-zinc deposits, fluid inclusions: Sawkins, F. J. 2925
Metals, base, acidity: Barnes, H. L. 2929

Mineral deposits, genesis
Ore-forming fluids
Nature from fluid inclusions: Roedder, Edwin. 2948
Ores in sedimentary rocks
Iron, exhalative and weathering processes: James, Harold L. 3074
Polymetallic ores
Yukon, Keno Hill–Galena Hill area: Boyle, R. W. 2937
Postmagmatic ore
Pneumatolytic stage, discredited: Ingerson, Earl. 2930
Sulfide–silicate systems
Reactions, ore fluid and enclosing rock: Kullerud, G. 2945
Zoning
Relation to paragenesis, Prague Symposium committee statement: Kutina, Jan. 2931

Mineral descriptions
Amosite
Chemical studies: Harington, J. S. 3275
Physical and molecular structure: Gaze, Richard. 3274
Anthophyllite
Physical and molecular structure: Gaze, Richard. 3274
Biotite
Polytypes, X-ray studies: Ross, Malcolm. 2994
Chrysotile
Chemical studies: Harington, J. S. 3275
Physical and molecular structure: Gaze, Richard. 3274
Crocidolite
Chemical studies: Harington, J. S. 3275
Physical and molecular structure: Gaze, Richard. 3274
Feldspars
Structures: Taylor, W. H. 3061
General
Structures, textbook: Bragg, Lawrence. 3062
Glauconite
Genesis and value in geologic studies: Triplehorn, D. M. 2978
Melilite
Solid solutions, lattice parameters: Edgar, A. D. 2828
Mica
Polytypes, X-ray studies: Ross, Malcolm. 2994
Synthetic, ammonium muscovite and phlogopite: Eugster, H. P. 2952
Orthoclase
Crystals, morphology in igneous rocks: Longshore, Judith Clark. 2989
Pyroxene
Properties and composition, Greenland, Kap Edvard Holm complex: Deer, W. A. 3323
Quartz
Phases, textbook: Sosman, Robert B. 3066
Sphalerite
Temperature of formation, use of FeS-content variation: Cleveland, John H. 3085

Mineral descriptions
Sphalerite
Trace-element solubility: Barnard, Walter M. 3140
Strontianite
Solubility, conditions for natural deposition: Helz, G. R. 2859
Weddellite
Crystal structure, Florida marine samples, nonprimary occurrence: Hutton, C. Osborne. 3324

Mineral exploration
Ore guides
Copper deposits, disseminated, weathered outcrops: Durek, Joseph John. 3147
New Mexico, Lake Valley district, jasperoids: Young, E. J. 3049
Statistical methods
Multivariate analysis: Harris, DeVerle Porter. 3143

Mineral resources
Oceans
Possibilities for metals, floor and water: Gaal, Robert. 3005

Mineral zoning
Definition
Prague Symposium committee: Kutina, Jan. 2931

Mineralogy
Classification
Mica, polytypes: Ross, Malcolm. 2994

Mining geology
Technology
Rock mechanics, dynamic properties of rock, sonic probe: Larocque, G. E. 3068
Rock mechanics, pillar strength, model studies: Obert, Leonard. 2830

Minnesota
Glacial geology
General: Wright, H. E., Jr. 3210
Maps
Geologic, Minneapolis–St. Paul area, bedrock: Payne, C. Marshall. 3038
Stratigraphy
Quaternary, Pleistocene drifts: Wright, H. E., Jr. 3210

Mississippi
Hydrogeology
Clay, Lowndes, Monroe, Oktibbeha Counties, Cretaceous aquifers: Wasson, B. E. 2995
Maps
Ground water, configuration on base of fresh-ground-water section: Newcome, Roy, Jr. 3040
Paleontology
Ostracoda, Oligocene, biostratigraphy: Mumma, Martin Dale. 3294

Mississippi Valley
Mineralogy
Sphalerite, FeS content, temperature indicator, cf. liquid inclusions: Cleveland, John H. 3085

Mississippian
Oklahoma
Northeastern, stratigraphy: Huffman, George G. 2901
Ouachita Mts., Wesley Formation: Hammes, Richard Robert. 3152
United States
Eastern interior, Cephalopoda: Knapp, William Dale. 3102
Missouri
Economic geology
Lead, southeastern, Bonneterre Dolomite: Henshaw, Paul C. 3002
Engineering geology
Foundations, St. Louis, Cherokee Cave under Route I-55: Laundrum, J. D. 2877
Geomorphology
Saint Louis, Cherokee Cave, foundation investigations: Laundrum, J. D. 2877
Paleontology
Stromatolites, Cambrian–Ordovician, digitate algal: Howe, W. B. 3048
Stratigraphy
Cambrian, Bonneterre Dolomite, southeastern: Henshaw, Paul C. 3002
Mollusca
Cretaceous
Arkansas, southwestern: Shreveport Geological Society. 2914
General
Collecting, nonmarine environments: Tasch, Paul. 2786
Quaternary
North America, central, Pleistocene nonmarine: Taylor, D. W. 3338
Septemchiton iowensis, n. sp.
Ordovician, Iowa, Maquoketa Shale, formerly tegmates: Sanders, Robert B. 2942
Tertiary
North Dakota, Cannonball Formation, bivalves: Cvancara, Alan Milton. 3221
Molybdenum
Genesis
Molybdenite deposition: Renault, Jacques Roland. 3111
Geochemistry
Lake and sea waters, biologic processes: Barsdate, Robert John. 3219
Montana
Absolute age
Little Belt and Beartooth Mts., zircons, discordant ages: Catanzaro, Edward John. 3150
Engineering geology
Dams, sites on Flathead River, Lake and Sanders Counties: Soward, Kenneth S. 2865
Maps
Geologic, damsites, Flathead River, Lake and Sanders Counties: Soward, Kenneth S. 2865
Geologic, Patricks Basin quadrangle: Mudge, Melville R. 2961
Montana
Paleontology
Mammalia, Miocene, Deer Lodge, Tavenner Ranch local fauna: Wood, Albert E. 2829
Petrology
Belt Series, diagenetic–metamorphic trends, layer silicates: Maxwell, Dwight Thomas. 3156
Stratigraphy
Patricks Basin quadrangle, section: Mudge, Melville R. 2961
Mud volcanoes
Causes
Exogenic: Kugler, H. G. 3320
Nebraska
Glacial geology
General: Reed, E. C. 3251
Paleontology
Mammalia, Pleistocene, western, list: Reed, E. C. 3251
Stratigraphy
Quaternary: Reed, E. C. 3251
Nevada
Areal geology
Rowland quadrangle: Bushnell, Kent Orpha. 3126
Earthquakes
General, epicenters, 1852–1961: Slemmons, D. B. 3270
Economic geology
Mineral resources, Stillwater Range, Churchill County: Page, Ben M. 3046
General
Bibliography, graduate theses on Nevada geology: Wilson, Roland V. 2999
Hydrogeology
Humboldt River valley near Winnemucca, Tertiary to Recent sediments: Cohen, Philip. 2866
Mercury area, volcanic tuff, properties, laboratory analysis: Johnson, Arnold I. 2932
Maps
Earthquake epicenters, 1852–1961: Slemmons, D. B. 3270
Geologic, Cane Spring quadrangle: Poole, F. G. 2839
Geologic, Churchill County, Stillwater Range: Page, Ben M. 3046
Geologic, Frenchman Flat quadrangle: Poole, F. G. 2835
Geologic, Giroux Wash quadrangle: Brokaw, Arnold L. 2962
Geologic, ground water, Humboldt River valley near Winnemucca: Cohen, Philip. 2866
Geologic, igneous rocks: Wilson, Roland V. 3271
Geologic, index to theses maps: Wilson, Roland V. 2999
Geologic, Topopah Spring NW quadrangle: Christiansen, Robert L. 2836
Petrology
Grant Range, ignimbrites: Scott, Robert Blackburn, 3d. 3112

Nevada
Stratigraphy
Cane Spring quadrangle, sections: Poole, F. G. 2839
Frenchman Flat quadrangle, section: Poole, F. G. 2835
Giroux Wash quadrangle, sections: Brokaw, Arnold L. 2962
Pennsylvanian–Permian, Bird Spring Group, Arrow Canyon Range: Lumsden, David Norman. 3104
Quaternary, Tule Springs area: Haynes, Caleb Vance, Jr. 3154
Stillwater Range, Churchill County: Page, Ben M. 3046
Tertiary, Grant Range: Scott, Robert Blackburn, 3d. 3112
Topopah Spring NW quadrangle, sections: Christiansen, Robert L. 2836
Structural geology
Stillwater Range, Churchill County: Page, Ben M. 3046
Western, earthquake faults and strike-slip control of basin and range: Shaw, Daniel R. 3013

New Brunswick
Maps
Aeromagnetic, Amherst area: Canada Geological Survey. 3344
Aeromagnetic, Bathurst area: Canada Geological Survey. 3351
Aeromagnetic, Campbellton area: Canada Geological Survey. 3352
Aeromagnetic, Charlottetown area: Canada Geological Survey. 3346
Aeromagnetic, Eastport area: Canada Geological Survey. 3343
Aeromagnetic, Edmundston area: Canada Geological Survey. 3339
Aeromagnetic, Fredericton area: Canada Geological Survey. 3345
Aeromagnetic, Gounamitz River area: Canada Geological Survey. 3390
Aeromagnetic, Grand Falls area: Canada Geological Survey. 3388
Aeromagnetic, Grand River area: Canada Geological Survey. 3389
Aeromagnetic, Grandmaison area: Canada Geological Survey. 3340
Aeromagnetic, Kedgwick area: Canada Geological Survey. 3387
Aeromagnetic, Lac Baker area: Canada Geological Survey. 3342
Aeromagnetic, Moncton area: Canada Geological Survey. 3347
Aeromagnetic, Riley Brook area: Canada Geological Survey. 3385
Aeromagnetic, Sisson area: Canada Geological Survey. 3386
Aeromagnetic, States Brook area: Canada Geological Survey. 3391
Aeromagnetic, Wild Goose Lake area: Canada Geological Survey. 3341
Aeromagnetic, Woodstock area: Canada Geological Survey. 3348

New England
Glacial geology
General: Schafer, J. P. 3249
Stratigraphy
Quaternary, Pleistocene correlation chart: Schafer, J. P. 3249

New Hampshire
Geochemistry
Fitzwilliam Granite, analysis: Stow, Stephen H. 2991

New Jersey
Geomorphology
Kingmill Beach, sediment transport, tracer study: Yasso, Warren E. 3289

New Mexico
Economic geology
Manganese, Walnut Wells quadrangle: Zeller, Robert A., Jr. 3006
Petroleum, Lea field, exploration: Franklin, D. W. 2847
Silver and manganese, possible new ore bodies: Young, E. J. 3049
Uranium, Ambrosia Lake district, Section 22 mine: Corbett, Robert Guy. 3220
Uranium, Sec. 23 mine, McKinley County: Young, W. E. 3058
Geochemistry
Laguna, hydrothermal alteration of sandstone pipes: Megrue, George H. 3012
Geophysical surveys
Lea oil field, seismic: Franklin, D. W. 2847
Hydrogeology
Ground-water levels, 1964: Busch, Fred E. 3077
Los Alamos area, Bandelier tuff, properties, laboratory analysis: Johnson, Arnold I. 2932
Three Rivers area, aquifers: Hood, James W. 2906
Maps
Geologic, Canador Peak quadrangle: Morrison, Roger B. 2905
Geologic, Walnut Wells quadrangle: Zeller, Robert A., Jr. 3006
Ground water, Three Rivers area: Hood, James W. 2906
Mineralogy
Ambrosia Lake uranium district, Section 22 mine: Corbett, Robert Guy. 3220
Petrology
Lake Valley district, jasperoids, favorability to ore deposits: Young, E. J. 3049
Walnut Wells quadrangle: Zeller, Robert A., Jr. 3006
Stratigraphy
Canador Peak quadrangle: Morrison, Roger B. 2905
Walnut Wells quadrangle: Zeller, Robert A., Jr. 3006
Structural geology
Walnut Wells quadrangle, deformations: Zeller, Robert A., Jr. 3006

New York
Areal geology
Albany to Lake George, guidebook: Isachsen, Yngvar W. 3035
Schenectady area, guidebook: New York State Geological Assoc. 3037
General
State Museum and Science Service, history: New York State Mus.and Sci.Service 2894
Glacial geology
General: Muller, Ernest H. 3248
Mohawk–Hudson River valleys, glacial–lake sequences: LaFleur, Robert G. 3036
Hydrogeology
Saratoga Springs area, Geyser Park, mineralized water, source: Hewitt, P. C. 3033
Maps
Geologic and tectonic, Albany–Lake George area: Isachsen, Yngvar W. 3035
Geologic, Mohawk Valley, lower: Fisher, Donald W. 3034
Paleontology
Cambrian–Ordovician, Mohawk Valley, lower, zones: Fisher, Donald W. 3034
Conodonts, Ordovician, Trenton Group: Schopf, Thomas Joseph Morton. 3031
Flora, Devonian, Catskill Mts.: Matten, Lawrence Charles. 3214
Man, fossil, Quaternary, artifacts: Ritchie, William A. 3212
Petrology
Adirondack Mts., northern, garnet isograds on gneisses: Buddington, A. F. 3322
Schuylerville area, Stark's Knob: Hewitt, P. C. 3033
Sedimentary petrology
Braddock Heights area, offshore sands, Lake Ontario: Sutton, R. G. 3183
Northern, Potsdam Formation, depositional environments: Otvos, Ervin G., Jr. 2976
Stratigraphy
Mohawk Valley, lower, Cambrian–Ordovician, guidebook: Fisher, Donald W. 3034
Quaternary, general: Muller, Ernest H. 3248
Structural geology
Clifton Park anticline and Stark's Knob: Hewitt, P. C. 3033
Mohawk Valley, lower, faults, guidebook: Fisher, Donald W. 3034

Newfoundland
Areal geology
Belleoram area: Anderson, F. D. 3041
Maps
Geologic, Belleoram area: Anderson, F. D. 3041

Nicaragua
Maps
Structure: Engels, Bruno. 3020
Petrology
Basement rocks: Engels, Bruno. 3020
Stratigraphy
Cretaceous–Tertiary: Engels, Bruno. 3020

Nicaragua
Structural geology
General: Engels, Bruno. 3020

Nodules
Manganese
Evolution in deep-sea environment, rate: Bender, M. L. 2957
Manganese and phosphorite
Economic geology, sea-floor occurrences: Gaal, Robert. 3005
Paleontology
Collecting techniques: Kauffman, Erle G. 2782

North America
Geochemistry
Lake sediments, Quaternary, organic and inorganic: Swain, F. M. 3202
Paleontology
Amphibia, Quaternary, speciation and distribution: Blair, W. Frank. 3307
Anthozoa, Devonian, *Smithiphyllum* emended: Pedder, A. E. H. 2958
Aves, Quaternary speciation, Pliocene origin discredited: Selander, Robert K. 3336
Invertebrata, Quaternary, biogeography: Frey, David G. 3304
Mammalia, Pleistocene, giant beaver: Stirton, R. A. 2935
Mammalia, Quaternary, range, stratigraphic and geographic: Hibbard, C. W. 3335
Mollusca, Pleistocene, nonmarine, central: Taylor, D. W. 3338
Pisces, Cenozoic, western, evolution: Smith, Gerald Ray. 3243
Pisces, Quaternary, freshwater, geologic range: Miller, Robert Rush. 3303
Reptilia, Quaternary, climatic effects: Auffenberg, Walter. 3337

North Carolina
Areal geology
Cape Fear River area, guidebook: Atlantic Coastal Plain Geol. Assoc. 2982
Sedimentary petrology
Coastal plain, Peedee Formation, origin: Swift, Donald Josiah Palmer. 3161

North Dakota
Paleontology
Mollusca, Paleocene, Cannonball Formation, bivalves: Cvancara, Alan Milton. 3221
Stratigraphy
Tertiary, Cannonball Formation, fossil groups: Cvancara, Alan Milton. 3221

Northwest Territories
Absolute age
Baffin Island, north-central, glacial chronology: Andrews, J. T. 3080
Geomorphology
Baffin Island, north-central, provinces: Andrews, J. T. 3080
Glacial geology
Baffin Island, north-central, chronology and geomorphology: Andrews, J. T. 3080
Maps
Glacial, Baffin Island, Cockburn and Isortoq map sheets: Andrews, J. T. 3080

Northwest Territories
Paleontology
Cephalopoda, Pennsylvanian, Hare Fiord Formation, Ellesmere Island: Nassichuk, Walter William. 3108

Nova Scotia
Maps
Aeromagnetic, Amherst area: Canada Geological Survey. 3344
Aeromagnetic, Eastport area: Canada Geological Survey. 3343
Aeromagnetic, Magdalen Islands area: Canada Geological Survey. 3349

Ohio
Economic geology
Mineral resources, Malvern quadrangle: DeLong, Richard M. 3272
Petroleum and natural gas, exploration and production, 1964: Norling, Donald L. 2903
Maps
Geologic, Malvern quadrangle: DeLong, Richard M. 3272
Stratigraphy
Malvern quadrangle, section: DeLong, Richard M. 3272

Oil and gas fields
Trinidad
Forest Reserve oil field: Bower, T. H. 3166
Review: Ablewhite, K. 3277

Oil sand
Resources
Alberta, Athabasca: deNevers, Noel. 3055

Oil sands
Geochemistry
Athabasca type, vanadyl porphyrin complexes: Milson, M. F. 3050

Oil shale
Colorado
Green River Formation, Mahogany Zone, conversion constants: Smith, John Ward. 3071
Resources
Western U.S., Green River shale: deNevers, Noel. 3055

Oklahoma
Areal geology
Northeastern,guidebook:Kansas Geological Society. 3076
Paleontology
Annelida, Cretaceous, Caddo Limestone, Choctaw County, serpulid: Branson, Carl C. 2912
Fauna, Ordovician–Pennsylvanian, northeastern: Huffman, George G. 2901
Sedimentary petrology
Southern, Trinity Group, clay mineral facies: Manley, Frederick Harrison, Jr. 3155
Stratigraphy
Carter County to Montague County, Texas, cross section: Ardmore Geological Society. 2916
Mississippian, Wesley Formation, Ouachita Mts.: Hammes, Richard Robert. 3152

Oklahoma
Stratigraphy
Northeastern, Ordovician–Pennsylvanian: Huffman, George G. 2901
Structural geology
Northeastern: Huffman, George G. 2901

Ontario
Geophysical surveys
McIntyre mine, acoustic velocity changes, probing system: Larocque, G. E. 3068
Paleontology
Conodonts, Ordovician, Trenton Group, southern: Schopf, Thomas Joseph Morton. 3031
Petrology
Chandos township, amphibolite classification, discriminant function analysis: Shaw, D. M. 3328
Sedimentary petrology
Eastern, Potsdam Formation, depositional environments: Otvos, Ervin G., Jr. 2976

Ordovician
Appalachians
Central, Upper, stratigraphy and petrology: Horowitz, Daniel Henry. 3131
Missouri
Lower, digitate algal stromatolites: Howe, W. B. 3048
New York
Mohawk Valley, lower, stratigraphy, guidebook: Fisher, Donald W. 3034
Oklahoma
Northeastern, stratigraphy: Huffman, George G. 2901
Northeastern, stratigraphy, guidebook: Kansas Geological Society. 3076
Pennsylvania
Central, Nittany Dolomite: Spelman, Allen Rathjen. 3138
Quebec
Gaspe Peninsula, Cloridorme Formation, new: Enos, Paul Portenier. 3129

Oregon
Glacial geology
History, Pleistocene advances: Crandell, Dwight R. 3255
Maps
Geologic, Aldrich Mtn. quadrangle: Thayer, T. P. 2967
Stratigraphy
Northern, Paleozoic–Cenozoic limestones, Cordilleran eugeosynclinal sequences: Danner, Wilbert R. 2933
Southwestern, Jurassic–Miocene, history: Koch, John G. 2975
Tertiary, Aldrich Mtn. quadrangle: Thayer, T. P. 2967
Structural geology
Aldrich Mtn. quadrangle, deformation: Thayer, T. P. 2967
Southwestern, tectonic history, Jurassic–Miocene: Koch, John G. 2975

Organic materials
Genesis
Crocidolite and amosite: Harington, J. S. 3275
Hydrocarbons
Meteorites: Urey, Harold C. 2993
Porphyrin
Athabasca oil sands, vanadyl complex with carbonyl group: Millson, M. F. 3050
Orogeny
Appalachian
Folding: Cloos, Ernst. 2873
Mechanism
Central America, Isthmian linkage and island arcs: Rode, K. P. 2938
Ostracoda
Quaternary
Georgia, Sapelo Island area: Hall, Donald D. 3098
Mexico, Baja California, Todos Santos Bay, Recent: Kaesler, Roger LeRoy. 3228
Mexico, Campeche, Laguna de Terminos, Recent, ecology and taxonomy: Morales-Frias, Gustavo Adolfo. 3231
Tertiary
Gulf Coastal Plain, Mississippi–Alabama, Oligocene: Mumma, Martin Dale. 3294
Paleobotany
Classification
Evolutionary reconstructions and taxonomy: Weller, J. Marvin. 2939
Devonian
New York, Catskill Mts.: Matten, Lawrence Charles. 3214
Environmental analysis
Rocky Mts., southern, Quaternary, modern floral elements: Weber, W. A. 3309
Methods
Collecting, coal balls: Mamay, S. H. 2886
Mesozoic and Cenozoic forms: Dorf, Erling. 2776
Palynology, statistical: Mosimann, James E. 2762
Palynomorphs, absolute frequency determination: Davis, Margaret B. 2763
Palynomorphs, collecting: Faegri, K. 2891
Palynomorphs, extraction: Gray, Jane. 2770
Palynomorphs, lake sediments sampling, coring devices: Wright, H. E. 2756
Palynomorphs, lake sediment sampling, corer: Deevey, Edward S., Jr. 2757
Palynomorphs, megaspores: Dettmann, Mary E. 2766
Palynomorphs, microscope slides, double layer mounting: Brideaux, W. W. 3082
Palynomorphs, mounting: Andersen, Svend T. 2758
Palynomorphs, photomicrography: Samuelsson, K. E. 2761
Palynomorphs, reference collection preparation, modern pollen: Traverse, Alfred. 2759
Palynomorphs, reference collection preparation, trapping: Lewis, Donald M. 2760
Paleobotany
Methods
Palynomorphs, sampling and preparation: Gray, Jane. 2817
Palynomorphs, sectioning, serial: Evitt, William R. 2765
Palynomorphs, sectioning, ultra-thin: Praglowski, J. Radwan. 2764
Nomenclature
Digitate stromatolite to replace *Collenia* and *Gymnosolen*: Howe, W. B. 3048
Technique
Polished sections, limonitic plant petrifactions: Matten, Lawrence C. 3081
Paleoclimatology
Cycles
Quaternary, astronomical theory: Broecker, W. S. 2956
Indicators
Colorado, western, paleosols: Power, Peter Edward. 3110
Tree rings, techniques: Fritts, Harold C. 3204
Quaternary
Hydrologic variations with changes: Schumm, S. A. 3203
Records, dating: Broecker, Wallace S. 3305
Theoretical study: Mitchell, J. Murray, Jr. 3205
United States, northeastern, palynology: Davis, Margaret B. 3332
United States, southwestern: Martin, Paul S. 3333
Paleoecology
Devonian
Neritic to littoral, Alberta, northeastern: Loranger, D. M. 3193
Mammalia
Terrestrial, North America, giant beaver: Stirton, R. A. 2935
Stromatolites
Cambrian–Ordovician, marine: Howe, W. B. 3048
Paleogeography
California
Santa Barbara County, Tertiary: Corey, William H. 3257
Cambrian
Missouri, southeastern, Upper: Henshaw, Paul C. 3002
New York–Ontario–Quebec, Upper: Otvos, Ervin G., Jr. 2976
Caribbean region
Cretaceous–Tertiary: Weyl, Richard. 2871
Central America
Cretaceous–Tertiary: Weyl, Richard. 2871
Gulf Coastal Plain
Jurassic to Cretaceous: Halbouty, Michel T. 2974
Jurassic
Gulf Coastal Plain, Upper: Thomas, William A. 2949
West Indies
Cretaceous–Tertiary: Weyl, Richard. 2871

Paleomagnetism
Quaternary
United States, correlation: Cox, Allan. 3207
Paleontology
Bibliography
Listing of available: Kummel, Bernhard. 2768
Classification
Evolutionary reconstructions and taxonomy: Weller, J. Marvin. 2939
Nomenclature, invalidation of nomina oblita: Branson, Carl C. 2934
Collecting
Elementary: Schuberth, Christopher J. 2899
Education
Elementary, fossils, uses: Matthews, William H., 3d. 2900
Methods
Anthozoa, collecting and sectioning: Oliver, William A., Jr. 2820
Arthropoda, chitinous, preparation: Brooks, H. K. 2827
Bibliography: Kummel, Bernhard. 2767
Brachiopoda, collecting: Dutro, J. T., Jr. 2822
Branchiopoda, collecting: Tasch, Paul. 2772
Bryozoa, sectioning: Ross, June R. P. Phillips. 2821
Casting and molding: Rigby, J. Keith. 2809
Casting and molding, plastics: Arnold, Zach M. 2810
Cephalopoda, collecting: Flower, Rousseau H. 2824
Chemical analysis, preparation: Dodd, James R. 2808
Collecting, accretionary structures: Kauffman, Erle G. 2782
Collecting amber: Langenheim, R. L., Jr. 2783
Collecting and preparation from fissure deposits: Kermack, K. A. 2785
Collecting, metamorphic rocks: Neuman, Robert B. 2780
Collecting, molds: Linsley, R. M. 2885
Collecting, nonmarine, biofacies approach: Tasch, Paul. 2786
Collecting, sedimentary rocks: Fisher, Donald W. 2778
Collecting, submarine: Brooks, H. K. 2781
Collecting, unconsolidated sediments: Sohl, Norman F. 2779
Conodonts, collecting: Collinson, Charles. 2887
Conodonts, magnetic separation: Dow, Verne E. 2796
Dating of archaeologic sites: Hole, Frank. 3211
Drawings, preparation: Isham, Lawrence B. 2888
Echinodermata, preparation: Durham, J. Wyatt. 2825
Foraminifera: Hofker, Jan. 2793
Foraminifera, larger, sectioning techniques: Douglass, Raymond C. 2818
Foraminifera, preparation, centrifuge: Arnold, Zack M. 2794
Gastropoda and Pelecypoda, collecting and preparation: Sohl, Norman F. 2823
Paleontology
Methods
Graptolithina, collecting and preparation: Berry, William B. N. 2773
Grinding, serial: Ager, D. V. 2787
Infrared photography: Rolfe, W. D. Ian. 2884
Modern, review of analytical techniques: Hooper, Kenneth. 2807
Peel: Stewart, Wilson N. 2788
Photography: Rasetti, Franco. 2811
Photography, illustrations, preparation: Palmer, Allison R. 2816
Photography, small fossils: Whittington, H. B. 2812
Photography, surface detail, whitening: Kier, Porter M. 2815
Photography, thin sections: Douglass, Raymond C. 2814
Pisces, collecting, preparation, and study: Schaeffer, Bobb. 2890
Pisces, otoliths, collecting and preparation: Frizzell, Don L. 2775
Porifera, collecting and preparation: Finks, Robert M. 2819
Preparations, fossils in amber: Langston, Robert L. 2802
Preparations, matrix removal, sandblasting: Stucker, G. F. 2799
Preparations, mechanical, rock trimmers: Roepke, Harlan H. 2798
Preparations, mechanical, vibro-tool: Robison, Richard A. 2797
Preparations, use of acids: Cooper, G. Arthur. 2803
Radiographic: Zangerl, Rainer. 2805
Reproductions, galvanoplastic: Zangerl, Rainer. 2892
Sampling: Krumbein, W. C. 2777
Textbook, sample collection and preparation: Kummel, Bernhard. 2769
Thin section preparation, Foraminifera, larger: Sachs, K. N., Jr. 2790
Thin sections, and peels for high magnification: Honjo, Susumu. 2791
Trilobita, preparation: Rasetti, Franco. 2826
Ultraviolet photography: Rolfe, W. D. Ian. 2806
Vertebrata, tetrapod collecting: Hotton, Nicholas, 3d. 2774
Textbooks
Methods, collection and preparation: Kummel, Bernhard. 2769
Paleozoic
Cephalopoda
Ammonoidea, late, taxonomy: Hodgkinson, Kenneth Allred. 3171
Palladium
Geochemistry
Basalt and ultrabasic rocks: Crocket, James H. 3090
Palynology
Cretaceous
Wyoming, Lower, northern: Davis, Phillip Nixon. 3127

Palynology
General
Elementary account: Prance, Ghillean. 2898
Sampling and preparation: Gray, Jane. 2817
Techniques, absolute-frequency determination: Davis, Margaret B. 2763
Techniques, extraction: Gray, Jane. 2770
Techniques, field collecting: Faegri, K. 2891
Techniques, lake sediments, coring devices: Wright, H. E. 2756
Techniques, lake-sediment sampling: Deevey, Edward S., Jr. 2757
Techniques, microscopic slides, double-layer mounting: Brideaux, W. W. 3082
Techniques, mounting: Andersen, Svend T. 2758
Techniques, photomicrography: Samuelsson, K. E. 2761
Techniques, reference-collection preparation, modern pollen: Traverse, Alfred. 2759
Techniques, reference-collection preparation, trapping: Lewis, Donald M. 2760
Techniques, sectioning, serial: Evitt, William R. 2765
Techniques, sectioning, ultra-thin: Praglowski, J. Radwan. 2764
Techniques, statistical: Mosimann, James E. 2762
Megaspores
Techniques, sample preparation: Dettmann, Mary E. 2766
Methods
Deposition in lakes, measurement, sediment traps: Davis, Margaret B. 3184
Pennsylvanian
Appalachians, northern, Allegheny coals: Gray, Lewis Richard. 3280
Quaternary
Great Lakes region, interpretation from modern distribution: Cushing, Edward J. 3311
Lake Superior region, late-glacial history: Wright, Herbert E., Jr. 3185
United States, eastern, unglaciated cf. modern: Whitehead, Donald R. 3310
United States, northeastern: Davis, Margaret B. 3332
United States, northwestern, including Alaska: Heusser, Calvin J. 3302
United States, southwestern, diagrams: Martin, Paul S. 3333

Paragenesis
General
Relation to zoning, Prague Symposium statement: Kutina, Jan. 2931
Silver-lead-zinc ores
Mexico, Zacatecas, Providencia mining area: Sawkins, F. J. 2924

Pebbles
Microstriation, polish
Tectonic origin: Clifton, H. Edward. 3196

Pebbles
Provenance
McDougall-Segur conglomerate, Alberta-British Columbia: Norris, D. K. 2920
Shape analysis
Shape index: Williams, Elizabeth M. 3179

Pelecypoda
Coralliochama flouriei
Cretaceous, Mexico, Baja California, Punta Banda: Damestoy, Guy. 3189
General
Collecting and preparation techniques: Sohl, Norman F. 2823
Tertiary
Atlantic Coastal Plain, upper, statistical analysis: Bird, Samuel O. 2940

Pennsylvania
Engineering geology
Shorelines, Lake Erie, Presque Isle Peninsula, beach-nourishment: Berg, Dennis W. 3291
Stratigraphy
Devonian, Upper, Bradford County: Woodrow, Donald Lawrence. 3239
Ordovician, Nittany Dolomite, central: Spelman, Allen Rathjen. 3138
Southern anthracite field, Silurian-Pennsylvanian: Trexler, John Peter. 3163
Structural geology
Southern anthracite field: Trexler, John Peter. 3163

Pennsylvanian
Appalachians
Northern coal field, palynology: Gray, Lewis Richard. 3280
Illinois
Carterville area, Carbondale Formation, Pteridophytes: Hibbert, F. A. 2960
Will-Kankakee Counties, worms: Richardson, E. S., Jr. 2955
Nevada
Arrow Canyon Range, Bird Spring Group, middle, microfacies: Lumsden, David Norman. 3104
Northwest Territories
Ellesmere Island, Ammonoidea: Nassichuk, Walter William. 3108
Oklahoma
Northeastern, stratigraphy: Huffman, George G. 2901

Periglacial features
Appalachians
Highlands: Richards, Horace G. 3250

Permian
Nevada
Arrow Canyon Range, Bird Spring Group, middle, microfacies: Lumsden, David Norman. 3104
Texas
West Texas basin, evaporites, origin: Moore, George W. 3157

Paleomagnetism
Quaternary
United States, correlation: Cox, Allan. 3207
Paleontology
Bibliography
Listing of available: Kummel, Bernhard. 2768
Classification
Evolutionary reconstructions and taxonomy: Weller, J. Marvin. 2939
Nomenclature, invalidation of nomina oblita: Branson, Carl C. 2934
Collecting
Elementary: Schuberth, Christopher J. 2899
Education
Elementary, fossils, uses: Matthews, William H., 3d. 2900
Methods
Anthozoa, collecting and sectioning: Oliver, William A., Jr. 2820
Arthropoda, chitinous, preparation: Brooks, H. K. 2827
Bibliography: Kummel, Bernhard. 2767
Brachiopoda, collecting: Dutro, J. T., Jr. 2822
Branchiopoda, collecting: Tasch, Paul. 2772
Bryozoa, sectioning: Ross, June R. P. Phillips. 2821
Casting and molding: Rigby, J. Keith. 2809
Casting and molding, plastics: Arnold, Zach M. 2810
Cephalopoda, collecting: Flower, Rousseau H. 2824
Chemical analysis, preparation: Dodd, James R. 2808
Collecting, accretionary structures: Kauffman, Erle G. 2782
Collecting amber: Langenheim, R. L., Jr. 2783
Collecting and preparation from fissure deposits: Kermack, K. A. 2785
Collecting, metamorphic rocks: Neuman, Robert B. 2780
Collecting, molds: Linsley, R. M. 2885
Collecting, nonmarine, biofacies approach: Tasch, Paul. 2786
Collecting, sedimentary rocks: Fisher, Donald W. 2778
Collecting, submarine: Brooks, H. K. 2781
Collecting, unconsolidated sediments: Sohl, Norman F. 2779
Conodonts, collecting: Collinson, Charles. 2887
Conodonts, magnetic separation: Dow, Verne E. 2796
Dating of archaeologic sites: Hole, Frank. 3211
Drawings, preparation: Isham, Lawrence B. 2888
Echinodermata, preparation: Durham, J. Wyatt. 2825
Foraminifera: Hofker, Jan. 2793
Foraminifera, larger, sectioning techniques: Douglass, Raymond C. 2818
Foraminifera, preparation, centrifuge: Arnold, Zack M. 2794
Gastropoda and Pelecypoda, collecting and preparation: Sohl, Norman F. 2823
Paleontology
Methods
Graptolithina, collecting and preparation: Berry, William B. N. 2773
Grinding, serial: Ager, D. V. 2787
Infrared photography: Rolfe, W. D. Ian. 2884
Modern, review of analytical techniques: Hooper, Kenneth. 2807
Peel: Stewart, Wilson N. 2788
Photography: Rasetti, Franco. 2811
Photography, illustrations, preparation: Palmer, Allison R. 2816
Photography, small fossils: Whittington, H. B. 2812
Photography, surface detail, whitening: Kier, Porter M. 2815
Photography, thin sections: Douglass, Raymond C. 2814
Pisces, collecting, preparation, and study: Schaeffer, Bobb. 2890
Pisces, otoliths, collecting and preparation: Frizzell, Don L. 2775
Porifera, collecting and preparation: Finks, Robert M. 2819
Preparations, fossils in amber: Langston, Robert L. 2802
Preparations, matrix removal, sandblasting: Stucker, G. F. 2799
Preparations, mechanical, rock trimmers: Roepke, Harlan H. 2798
Preparations, mechanical, vibro tool: Robison, Richard A. 2797
Preparations, use of acids: Cooper, G. Arthur. 2803
Radiographic: Zangerl, Rainer. 2805
Reproductions, galvanoplastic: Zangerl, Rainer. 2892
Sampling: Krumbein, W. C. 2777
Textbook, sample collection and preparation: Kummel, Bernhard. 2769
Thin section preparation, Foraminifera, larger: Sachs, K. N., Jr. 2790
Thin sections, and peels for high magnification: Honjo, Susumu. 2791
Trilobita, preparation: Rasetti, Franco. 2826
Ultraviolet photography: Rolfe, W. D. Ian. 2806
Vertebrata, tetrapod collecting: Hotton, Nicholas, 3d. 2774
Textbooks
Methods, collection and preparation: Kummel, Bernhard. 2769
Paleozoic
Cephalopoda
Ammonoidea, late, taxonomy: Hodgkinson, Kenneth Allred. 3171
Palladium
Geochemistry
Basalt and ultrabasic rocks: Crocket, James H. 3090
Palynology
Cretaceous
Wyoming, Lower, northern: Davis, Phillip Nixon. 3127

Palynology
General
Elementary account: Prance, Ghillean. 2898
Sampling and preparation: Gray, Jane. 2817
Techniques, absolute-frequency determination: Davis, Margaret B. 2763
Techniques, extraction: Gray, Jane. 2770
Techniques, field collecting: Faegri, K. 2891
Techniques, lake sediments, coring devices: Wright, H. E. 2756
Techniques, lake-sediment sampling: Deevey, Edward S., Jr. 2757
Techniques, microscopic slides, double-layer mounting: Brideaux, W. W. 3082
Techniques, mounting: Andersen, Svend T. 2758
Techniques, photomicrography: Samuelsson, K. E. 2761
Techniques, reference-collection preparation, modern pollen: Traverse, Alfred. 2759
Techniques, reference-collection preparation, trapping: Lewis, Donald M. 2760
Techniques, sectioning, serial: Evitt, William R. 2765
Techniques, sectioning, ultra-thin: Praglowski, J. Radwan. 2764
Techniques, statistical: Mosimann, James E. 2762
Megaspores
Techniques, sample preparation: Dettmann, Mary E. 2766
Methods
Deposition in lakes, measurement, sediment traps: Davis, Margaret B. 3184
Pennsylvanian
Appalachians, northern, Allegheny coals: Gray, Lewis Richard. 3280
Quaternary
Great Lakes region, interpretation from modern distribution: Cushing, Edward J. 3311
Lake Superior region, late-glacial history: Wright, Herbert E., Jr. 3185
United States, eastern, unglaciated cf. modern: Whitehead, Donald R. 3310
United States, northeastern: Davis, Margaret B. 3332
United States, northwestern, including Alaska: Heusser, Calvin J. 3302
United States, southwestern, diagrams: Martin, Paul S. 3333

Paragenesis
General
Relation to zoning, Prague Symposium statement: Kutina, Jan. 2931
Silver-lead-zinc ores
Mexico, Zacatecas, Providencia mining area: Sawkins, F. J. 2924

Pebbles
Microstriation, polish
Tectonic origin: Clifton, H. Edward. 3196

Pebbles
Provenance
McDougall-Segur conglomerate, Alberta-British Columbia: Norris, D. K. 2920
Shape analysis
Shape index: Williams, Elizabeth M. 3179

Pelecypoda
Coralliochama flouriei
Cretaceous, Mexico, Baja California, Punta Banda: Damestoy, Guy. 3189
General
Collecting and preparation techniques: Sohl, Norman F. 2823
Tertiary
Atlantic Coastal Plain, upper, statistical analysis: Bird, Samuel O. 2940

Pennsylvania
Engineering geology
Shorelines, Lake Erie, Presque Isle Peninsula, beach-nourishment: Berg, Dennis W. 3291
Stratigraphy
Devonian, Upper, Bradford County: Woodrow, Donald Lawrence. 3239
Ordovician, Nittany Dolomite, central: Spelman, Allen Rathjen. 3138
Southern anthracite field, Silurian-Pennsylvanian: Trexler, John Peter. 3163
Structural geology
Southern anthracite field: Trexler, John Peter. 3163

Pennsylvanian
Appalachians
Northern coal field, palynology: Gray, Lewis Richard. 3280
Illinois
Carterville area, Carbondale Formation, Pteridophytes: Hibbert, F. A. 2960
Will-Kankakee Counties, worms: Richardson, E. S., Jr. 2955
Nevada
Arrow Canyon Range, Bird Spring Group, middle, microfacies: Lumsden, David Norman. 3104
Northwest Territories
Ellesmere Island, Ammonoidea: Nassichuk, Walter William. 3108
Oklahoma
Northeastern, stratigraphy: Huffman, George G. 2901

Periglacial features
Appalachians
Highlands: Richards, Horace G. 3250

Permian
Nevada
Arrow Canyon Range, Bird Spring Group, middle, microfacies: Lumsden, David Norman. 3104
Texas
West Texas basin, evaporites, origin: Moore, George W. 3157

Petrofabrics
Interpretation
X-ray diffraction analysis, fine-grained rocks: Chen, Ju-chin. 2988
Petroleum
Kansas
Brehm field, exploration and production: Bird, W. E. 2848
Kentucky
Cumberland City quadrangle, resources: Lewis, Richard Q., Sr. 2861
Phil quadrangle, resources: Maxwell, Charles H. 3023
Sonora quadrangle, resources: Moore, Frank B. 2840
Stricklett quadrangle, resources: Morris, Robert H. 2864
New Mexico
Lea field, exploration: Franklin, D. W. 2847
Ohio
Exploration and production, summary 1964: Norling, Donald L. 2903
Reserves
Estimation, sandstone reservoirs, porosity decrease with depth: Atwater, Gordon I. 2972
Texas
Big Hill field: Dollison, R. S. 2986
Northern, Ellenburger pools: Cole, Frank W. 3032
Southeastern, trap possibilities: Halbouty, Michel T. 2974
West Virginia
Resources: Haught, Oscar L. 3186
Wyoming
Pierce Reservoir quadrangle, resources: Hyden, Harold J. 3004
Petrology
Textbooks
Metamorphic rocks, petrogenesis, mineralogical chemical aspects: Winkler, G. F. 2919
Phase equilibria
Ag–Bi–S or Ag–Bi–Pb–S
Geologic significance: Craig, James Roland. 3117
Al_2O_3–SiO_2 system
Solubilities in Al silicate–Na–Al fluoride system: Weill, D. F. 3047
Ca–Na sulfates + water
Evaporite minerals: Hardie, Lawrence Alexander. 3226
CaO–MgO–SiO_2–CO_2–H_2O:
Franz, Gilbert Wayne. 3142
CaO–MgO–SiO_2–H_2O
Melting relations: Franz, G. W. 3089
Carbonatites
Melting relationships: Watkinson, David Hugh. 3241
Fe–S–O–SiO_2
Sulfide ore, genesis: Kullerud, G. 2945
Gehlinite–akermanite–soda melilite
Summary of relations: Edgar, A. D. 2828
Phase equilibria
Sb_2S_3–Na_2S–H_2O
Stibnite deposition: Norton, Denis Locklin. 3232
SiO_2–H_2O: Sosman, Robert B. 3066
Sphalerite system
Solubility study: Barnard, Walter M. 3140
Spinel solid-solution series: Ulmer, Gene Carlton. 3215
Titania and titania–boric oxide: Beard, William Clarence. 3144
Photogeology
Hawaii
Kilauea volcano, structure from infrared photographs: Fischer, William A. 3276
Pisces
General
Collecting, preparation, study techniques: Schaeffer, Bobb. 2890
Otoliths
Collecting and preparation techniques: Frizzell, Don L. 2775
Pantosteus
Cenozoic, North America, western, evolution: Smith, Gerald Ray. 3243
Quaternary
North America, freshwater, geologic range: Miller, Robert Rush. 3303
Popular and elementary geology
Dinosaurs
Duck-billed, land dwelling, evidence: Ostrom, John H. 2897
Fossil collecting: Schuberth, Christopher J. 2899
Fossil pollen
Collecting and study: Prance, Ghillean. 2898
Reefs: Silverberg, Robert. 3059
Tektites
Genesis: Broughton, Paul. 2979
Porifera
Spongiae
Preparation and collecting techniques: Finks, Robert M. 2819
Precambrian
Wisconsin
Florence County, Animikean Series: Nilsen, Tor H. 3290
Prince Edward Island
Maps
Aeromagnetic, Bathurst area: Canada Geological Survey. 3351
Aeromagnetic, Bradelle Bank area: Canada Geological Survey. 3350
Aeromagnetic, Charlottetown area: Canada Geological Survey. 3346
Aeromagnetic, Moncton area: Canada Geological Survey. 3347
Protista
Coccolithophores
Tertiary, Alabama, index fossils: Joerger, Arthur Peter. 3292
Pteridophytes
Paracalamostachys
Pennsylvanian, Illinois, Carbondale Formation: Hibbert, F. A. 2960

Puerto Rico
Geophysical surveys
General, radioactivity: MacKallor, Jules A. 3260
Maps
Radioactivity, natural gamma, airborne: MacKallor, Jules A. 3260
Sedimentary petrology
Parguera Limestone, origin: Almy, Charles Coit, Jr. 3217
Stratigraphy
Cretaceous, Parguera Limestone, southwestern: Almy, Charles Coit, Jr. 3217
Quaternary
Alaska
Barrow area, Gubik Formation, late Pleistocene: Sellman, Paul V. 2910
General, stratigraphy: Pewe, Troy L. 3331
Angiosperms
Polyploidy, frequency at high latitudes: Johnson, Albert W. 3334
Atlantic Coastal Plain
Pleistocene stratigraphy: Richards, Horace G. 3250
California
General stratigraphy: Wahrhaftig, Clyde. 3254
Los Angeles County, southwestern, stratigraphy: Riccio, Joseph Frank. 3136
Canada
Hudson Bay, Foraminifera, paleoecology and ecology: Leslie, Robert James. 3132
Colorado
Correlation, Ouray County: Mather, Kirtley F. 3016
Piedmont, nonglacial stratigraphy: Scott, Glenn R. 3253
Colorado Plateau
General, stratigraphy: Kottlowski, Frank E. 3312
General
Biogeography and Pleistocene nonmarine environments: Deevey, Edward S., Jr. 3319
Bryophytes, world distribution: Steere, William C. 3308
Paleoclimatology, theoretical study: Mitchell, J. Murray, Jr. 3205
Georgia
Sapelo Island area, Ostracoda: Hall, Donald D. 3098
Great Lakes region
Lakes Erie and Ontario area, glacial history and stratigraphy: Goldthwait, Richard P. 3247
Greenland
Shorelines, bibliography: Richards, Horace G. 3001
Gulf Coastal Plain
Stratigraphy and geomorphology: Bernard, Hugh A. 3313
Hawaii
Shorelines, bibliography: Richards, Horace G. 3001
Quaternary
Idaho
Snake River Plain, stratigraphy and volcanism: Malde, Harold E. 3316
Illinois
Glacial history and stratigraphy: Frye, John C. 3245
Indiana
Glacial history and stratigraphy: Wayne, William J. 3246
Iowa
Glacial history and stratigraphy: Wright, H. E., Jr. 3210
Kansas
McPherson County, Meade and Sanborn Groups, stratigraphy and paleontology: Semken, Holmes Alford, Jr. 3235
Northern, Pleistocene stratigraphy: Reed, E. C. 3251
Lake Superior region
Palynology, late-glacial history: Wright, Herbert E., Jr. 3185
Michigan
Glacial history and stratigraphy: Wayne, William J. 3246
Minnesota
Glacial history and stratigraphy: Wright, H. E., Jr. 3210
Nebraska
Pleistocene stratigraphy: Reed, E. C. 3251
Nevada
Tule Springs area, stratigraphy and mammals: Haynes, Caleb Vance, Jr. 3154
New England
Glacial history and stratigraphy: Schafer, J. P. 3249
New York
Glacial history and stratigraphy: Muller, Ernest H. 3248
North America
Amphibia, speciation and distribution: Blair, W. Frank. 3307
Aves, speciation: Selander, Robert K. 3336
Central, Mollusca, Pleistocene nonmarine: Taylor, D. W. 3338
Invertebrata, biogeography: Frey, David G. 3304
Mammalia, general: Hibbard, C. W. 3335
Pisces, freshwater, geologic range: Miller, Robert Rush. 3303
Reptilia, climatic effects: Auffenberg, Walter. 3337
Shorelines, bibliography: Richards, Horace G. 3001
Oregon
Glacial history: Crandell, Dwight R. 3255
Rocky Mountains
Correlation: Richmond, Gerald M. 3252
Southern and middle basins, nonglacial stratigraphy: Scott, Glenn R. 3253
South Dakota
Eastern, Pleistocene, correlation: Grimes, Walter W. 3026

Quaternary
United States
Basin and Range province, southern, stratigraphy: Kottlowski, Frank E. 3312
Concepts, history of growth: Flint, Richard Foster. 3317
Continental shelf, changes of level: Curray, Joseph R. 3283
Eastern, unglaciated, palynology: Whitehead, Donald R. 3310
General, review volume: Wright, H. E., Jr. 3285
Great Basin, stratigraphy: Morrison, Roger B. 3301
Great Plains, northern, Pleistocene stratigraphy: Lemke, R. W. 3244
Great Plains, southern, stratigraphy: Frye, John C. 3299
Insecta, Pleistocene dispersals: Ross, Herbert H. 3306
Northeastern, glacial events, related artifacts: Ritchie, William A. 3212
Pacific Coast, man, fossil: Meighan, Clement W. 3209
Pacific Northwest, including Alaska, palynology: Heusser, Calvin J. 3302
Paleosols: Ruhe, Robert V. 3208
Southeastern, man, fossil, distribution from fluted points: Williams, Stephen. 3286
Southwestern, palynology: Martin, Paul S. 3333
Western, stratigraphy, ash falls as markers: Wilcox, Ray E. 3206
Washington
Glacial history: Crandell, Dwight R. 3255
West Indies
Shorelines, bibliography: Richards, Horace G. 3001
Wisconsin
Glacial history and stratigraphy: Frye, John C. 3245

Quebec
Areal geology
Lac Herodier area: Fahrig, W. F. 3039
Maps
Aeromagnetic, Bradelle Bank area: Canada Geological Survey. 3350
Aeromagnetic, Magdalen Islands area: Canada Geological Survey. 3349
Geologic, Lac Herodier area: Fahrig, W. F. 3039
Paleontology
Conodonts, Ordovician, Trenton Group: Schopf, Thomas Joseph Morton. 3031
Sedimentary petrology
Southwestern, Potsdam Formation, depositional environments: Otvos, Ervin G., Jr. 2976
Stratigraphy
Ordovician, Cloridorme Formation, Gaspe Peninsula, new: Enos, Paul Portenier. 3129

Radioactivity
Soils
Indiana: Ziemer, Paul L. 3086

Radioactivity surveys
Idaho
National Reactor Testing Station area, airborne: Bates, Robert G. 3321
Puerto Rico
General, airborne: MacKallor, Jules A. 3260

Radiolaria
General
Preparation techniques, indurated tuff: Burma, Benjamin H. 2771

Reefs
Alberta
Devonian, Upper, Southesk reef, marginal lithofacies: MacKenzie, W. S. 3070
Florida
Quaternary, Ten Thousand Islands area, vermetid: Shier, Daniel Edward. 3159
General
Popular account: Silverberg, Robert. 3059

Reptilia
Quaternary
North America, climatic effects: Auffenberg, Walter. 3337
Trachodontidae
Land-dwelling, evidence, elementary account: Ostrom, John H. 2897

Rhode Island
Economic geology
Gravel, Voluntown quadrangle: Feininger, Tomas. 2831
Glacial geology
Voluntown quadrangle, history and deposits: Feininger, Tomas. 2831
Maps
Aeromagnetic, Ashaway and Watch Hill quadrangles: Boynton, G. R. 3269
Aeromagnetic, Oneco quadrangle: Boynton, G. R. 3264
Aeromagnetic, Voluntown quadrangle: Boynton, G. R. 3267
Surficial geology, Voluntown quadrangle: Feininger, Tomas. 2831
Surficial geology, Watch Hill quadrangle: Schafer, J. P. 2833

Rivers
Channel geometry
Meanders, minimum variance theory: Langbein, Walter B. 3051
Sediment transport
Discharge in alluvial channels, total bed-material: Chang, F. M. 2867
Experimental study, antidune structures: Middleton, G. V. 3288
Watersheds
Runoff, effect of landform characteristics: Hidore, John J. 2944

Rocky Mountains
Geomorphology
Southern and middle basins, terraces and pediments: Scott, Glenn R. 3253
Glacial geology
General, Quaternary glaciations: Richmond, Gerald M. 3252
Northern, Cordilleran ice sheet: Richmond, Gerald M. 3300

Rocky Mountains
Stratigraphy
Quaternary, correlation: Richmond, Gerald M. 3252
Quaternary, southern and middle basins, nonglacial: Scott, Glenn R. 3253
Sandstone
Tennessee
Jones Knob quadrangle, resources: Coker, Alfred E. 3042
Saskatchewan
Areal geology
Wood Mtn. area: Whitaker, Sidney Hopkins. 3115
Glacial geology
Wood Mtn. area: Whitaker, Sidney Hopkins. 3115
Maps
Aeromagnetic, McAdam Lake area: Canada Geological Survey. 2893
Oil and gas, fields and discoveries: MacLean, Brian. 2908
Sedimentary rocks
Argillites
Statistical analysis of varves, Canada, Precambrian: Jackson, Togwell A. 3198
Chert
Optical properties, undulose extinction: Carver, Robert E. 3201
Conglomerates
Provenance, Alberta–British Columbia, Cretaceous, McDougall–Segur horizon: Norris, D. K. 2920
Provenance and transportation, novaculite boulders, Arkansas: Stone, Charles G. 3073
Evaporites
Geochemistry and genesis: Moore, George W. 3157
General
Diagenesis, cementation: Warner, Mont M. 3192
Petrology, polished, striated pebbles, tectonic origin: Clifton, H. Edward. 3196
Provenance, heavy minerals, Colorado: Briggs, Louis I. 3175
Iron-rich
Geochemistry, general: James, Harold L. 3074
Limestone
Abundance, Cordilleran eugeosynclinal sequences: Danner, Wilbert R. 2933
Geochemistry, strontium in oolites: Kahle, Charles F. 3194
Texture, spherulitic, Wyoming, Morrison Formation: Weiss, Malcolm P. 3178
Lithofacies
Alberta, Upper Devonian, Southesk reef margin, Mt. MacKenzie area: MacKenzie, W. S. 3070
Methods
Grain-size analysis, sieves, maximum load: McManus, Dean A. 3191
Grain-size analysis, statistical: Meland, Nils. 3177
Grain-size analysis, statistical: Sahu, Basanta K. 3172
Sedimentary rocks
Methods
Grain-size analysis, statistical: Sahu, Basanta K. 3200
Microscope, undulose extinction in fine-grained: Carver, Robert E. 3201
Quartzite
Alteration and provenance, Wisconsin: Nilsen, Tor H. 3290
Sandstone
Porosity, decrease with depth, oil and gas reserves: Atwater, Gordoo I. 2972
Turbidites
Texture, particle orientation: Rukavina, Norman Andrew. 3233
Sedimentary structures
Conical slip marks
Genesis in shale, non-organic origin: Wood, Alan. 3180
Crossbedding
Experimental study, antidunes in laboratory flume: Middleton, G. V. 3288
Foreset profiles, experimental study: Jopling, Alan V. 3190
Wisconsin, Animikean Series: Nilsen, Tor H. 3290
General
North Carolina, Cape Fear River area, basal Cretaceous beds: Atlantic Coastal Plain Geol. Assoc. 2982
Ice-cemented blocks
Rhode Island, beach, possibilities: Dillon, William P. 3176
Oolites
Wyoming, Morrison Formation, spherulitic limestone: Weiss, Malcolm P. 3178
Ripple marks
Lake Michigan, southeastern, physical properties: Davis, Richard A., Jr. 3195
Swash zone: Tanner, William F. 3199
Sedimentary volcanism features
Classification, endo- and exogenic causes: Kugler, H. G. 3320
Varves
Canada, Precambrian argillites: Jackson, Togwell A. 3198
Sedimentation
Climatic factors
Effect of changes in Quaternary: Schumm, S. A. 3203
Environment
Coastal, hurricane effects, Texas: Hayes, Miles Oren. 2973
Deltaic, Gulf of California, Colorado delta mudflats: Thompson, Robert Wayne. 3139
Lacustrine, nearshore, Lake Michigan: Davis, Richard Albert, Jr. 3128
Lacustrine, Quaternary, geochemistry: Swain, F. M. 3202
Experimental studies
Beach sand transport, size-velocity relationships, fluorescent tracers: Yasso, Warren E. 3289

Sedimentation
Experimental studies
Beaches, sediment transport, fluorescent tracer method: Schwartz, Maurice L. 2951
Laboratory deltas, hydraulic factors in shape of laminae: Jopling, Alan V. 3190
Settling velocities, granule, and pebble-sized clasts: Pirie, R. Gordon. 3182
Rates
Caribbean Sea, Th-230 dating: Ku, Teh-Lung. 2953
New Jersey, beach sand: Yasso, Warren E. 3289
Stream transport
Discharge in alluvial channels, total bed material: Chang, F. M. 2867
Dune bed, flow resistance, geometric quantities: Hwang, Li-San. 3145
Experimental study, laboratory flume, antidune deposits: Middleton, G. V. 3288
Turbidity currents
Particle orientation: Rukavina, Norman Andrew. 3233
Trinidad, Cipero Formation, Herrera sands: Poole, W. G. 3168
Wind transport
Sand, mechanism: Kadib, Abdel-Latif Abdullah. 3296
Sediments
Clay
Consolidation, physical-chemical factors: Warner, Don Lee. 3237
General
Provenance, Colorado River delta: Merriam, Richard. 3174
Globigerina ooze
Absolute age and sedimentation rate, Caribbean Sea: Ku, Teh-Lung. 2953
Methods
Fossil collecting: Sohl, Norman F. 2779
Grain-size analysis, statistical: Meland, Nils. 3177
Grain-size analysis, statistical: Sahu, Basanta K. 3172
Grain-size analysis, statistical: Sahu, Basanta K. 3200
Size analysis, sieves, maximum load: McManus, Dean A. 3191
Mud
Genesis, lime type, British Honduras, southern: Matthews, Robley Knight. 3105
Sand
Classification, size, graded bed material in alluvial channels: Chang, F. M. 2867
General description, New York, Lake Ontario: Sutton, R. G. 3183
Mineral composition, grain size, Atlantic Coast, southern U.S.: Giles, Robert T. 3173
Seismic exploration
Interpretation
Faults, criteria: Campbell, Francis P. 2849
Technique
Multiple reflection cancellation: Silverman, Daniel. 2851
Seismic exploration
Technique
Reflection, crustal studies: Dix, C. H. 2869
Velocity and frequency filtering: Dobrin, Milton B. 2843
Seismic surveys
Kansas
Brehm oil and gas field: Bird, W. E. 2848
Manitoba
Conrad and M-discontinuities: Hall, D. H. 2850
New Mexico
Lea oil field: Franklin, D. W. 2847
Seismology
Elastic waves
Free oscillations, Alaskan earthquakes, 1964: Wirth, Hans. 3079
P-wave, component in short-period noise: Seriff, A. J. 2841
Shore features
Beaches
Bibliography, selected: Dolan, Robert. 2996
Sand, cf. dune and river, southern Atlantic Coast, U. S.: Giles, Robert T. 3173
Sedimentation, fluorescent tracer study: Schwartz, Maurice L. 2951
Sedimentation, sand transport rate, fluorescent tracers: Yasso, Warren E. 3289
Shorelines
Ancient, ripple marks as criteria: Davis, Richard A., Jr. 3195
Silicon
Geochemistry
SiO_2 phases: Sosman, Robert B. 3066
Silurian
Appalachians
Central, Lower, stratigraphy and petrology: Horowitz, Daniel Henry. 3131
Michigan
Michigan basin, reefs, stratigraphy: Felber, Bernhard E. 3224
Silver
New Mexico
Lake Valley district, possible new ore bodies: Young, E. J. 3049
Soils
Engineering properties
Clays, stabilization by chemical additives, surface energy concept: Heagler, John B., Jr. 2880
Hydraulic, determination, field method: Stibbe, Ehud. 3160
Terrain factors, quantitative, airphoto analysis: Vadnais, Raymond R., Jr. 3093
Hawaii
Mauna Kea-ash, weathering: Houng, Kun-Huang. 3213
Indiana
Radioactivity: Ziemer, Paul L. 3086
Paleosols
United States, Quaternary: Ruhe, Robert V. 3208

Soils
Texas
Kimble County, caliche: Blank, Horace R. 3015
South Carolina
Geomorphology
Coastal Plain, central, terraces: Atlantic Coastal Plain Geol. Assoc. 2922
Sedimentary petrology
Coastal plain, Peedee Formation, origin: Swift, Donald Josiah Palmer. 3161
Stratigraphy
Cenozoic, Coastal Plain, central, terraces: Atlantic Coastal Plain Geol. Assoc. 2922
South Dakota
Engineering geology
Highways, eastern, foundation problems in glacial deposits: Grimes, Walter W. 3026
Glacial geology
Eastern, deposits and features: Grimes, Walter W. 3026
Stratigraphy
Quaternary, eastern, Pleistocene, correlation: Grimes, Walter W. 3026
Spectroscopy
Absorption
Silicates: Burns, Roger George. 3096
Electron probe
Olivine, cf. wet chemical methods: Smith, J. V. 3329
Infrared
Fossils, technique: Rolfe, W. D. Ian. 2884
Ultraviolet
Fossils, technique: Rolfe, W. D. Ian. 2806
Statistical measures
Ecology
Invertebrata, least squares search for infaunal frequencies: Harrison, W. 3282
Statistical methods
Economic geology
Multivariate analysis in mineral exploration: Harris, DeVerle Porter. 3143
Paleobotany
Multinomial and negative multinomial techniques: Mosimann, James E. 2762
Paleontology
Rogers Tanimoto analysis of species: Bird, Samuel O. 2940
Sampling: Krumbein, W. C. 2777
Petrology
Discriminant function analysis, amphibolite classification, Ontario: Shaw, D. M. 3328
Sedimentary petrology
Grain size analysis, sieve data *n*: Meland, Nils. 3177
Grain size analysis, transformation, arithmetic to phi moments: Sahu, Basanta K. 3172
Grain size analysis, transformation, weight and number frequencies: Sahu, Basanta K. 3200
Pebble shape analysis, shape index: Williams, Elizabeth M. 3179
Power spectrum analysis, varved argillites: Jackson, Togwell A. 3198
Statistical methods
Sedimentary petrology
Size frequency analysis, heavy minerals: Briggs, Louis I. 3175
Stratigraphy
Bibliography
Listing of available: Kummel, Bernhard. 2768
Methods
Glauconite as correlation tool and tracer: Triplehorn, D. M. 2978
Stream capture
United States
Southwestern, arroyos, thalweg–contour study: Wertz, Jacques B. 3188
Stromatolites
Cambrian
Missouri, Upper, digitate algal: Howe, W. B. 3048
Nomenclature
Digitate to replace *Collenia* or *Gymnosolen*: Howe, W. B. 3048
Ordovician
Missouri, Lower, digitate algal: Howe, W. B. 3048
Stromatoporoidea
Devonian
Iowa, Coralville Member, of Cedar Valley Limestone, Iowa City area: Pestana, Harold Richard. 3109
Strontium
Geochemistry
Limestone, oolitic, loss with age: Kahle, Charles F. 3194
Structural geology
Textbooks
College level: Badgley, Peter C. 3065
Submarine geology
Bottom features
Maine, Gulf of Maine, Northeast Channel: Uchupi, Elazar. 2977
Paleontology
Collecting techniques: Brooks, H. K. 2781
Sediments
Caribbean Sea, absolute age and sedimentation rate: Ku, Teh-Lung. 2953
Sulfur
Geochemistry
Content in coal, Appalachian region: Deurbrouck, A. W. 3003
Reaction with silicates in ore genesis: Kullerud, G. 2945
Surveys
New York State Museum and Science Service
History: New York State Mus.and Sci.Service 2894
Talc
Virginia
Albemarle County, Old Dominion area, soapstone deposits: Greenberg, S. S. 3069
Tectonics
Basin range structure
Recent, strikes-lip control, Nevada: Shaw, Daniel R. 3013

Tectonics
General
Quaternary, United States: King, Philip B. 3284
Horizontal movements
Recent, Hayward fault zone, California: Radbruch, Dorothy H. 2980
Principles
Textbook: Badgley, Peter C. 3065
Thrust faulting
Mechanics, osmotic effect, shale-bearing sections with evaporites: Hanshaw, Bruce B. 3014

Tektites
Genesis
Theories summarized,popular account: Broughton,Paul. 2979

Tennessee
Economic geology
Coal and sandstone, Jones Knob quadrangle: Coker, Alfred E. 3042
Limestone, dolomite, iron, Morristown quadrangle: Swingle, George D. 3045
Maps
Geologic and coal seams, Jones Knob quadrangle: Coker, Alfred E. 3042
Geologic, Morristown quadrangle: Oder, Charles R. L. 3044
Stratigraphy
Cretaceous, below McNairy Sand: Russell, Ernest Everett. 3137
Morristown quadrangle, section: Oder, Charles R. L. 3044

Terraces
California
Marine, Quaternary: Wahrhaftig, Clyde. 3254
Colorado
Piedmont: Scott, Glenn R. 3253
Rocky Mountains
Southern and middle basins: Scott, Glenn R. 3253
South Carolina
Coastal Plain, central: Atlantic Coastal Plain Geol. Assoc. 2922

Tertiary
Alabama
Lisbon Formation, biostratigraphy: Oman, Carl Henry. 3158
Southwestern, Protista, Eocene-Oligocene index fossils: Joerger, Arthur Peter. 3292
Arkansas
Central, Clayton Formation, novaculite boulders: Stone, Charles G. 3073
Atlantic Coastal Plain
Maryland-Virginia-North Carolina, upper, Pelecypoda Gastropoda: Bird, Samuel O: 2940
California
Santa Barbara County, lower formations, zones: Corey, William H. 3257
Santa Ynez Mts., Rincon Formation, stratigraphy and Foraminifera: Carson, Carlton M. 3258
Santa Ynez Mts., western, stratigraphy and Foraminifera: Weaver, Donald W. 3256

Tertiary
Colorado
Huerfano Park, provenance: Briggs, Louis I. 3175
Park County, Antero Formation and Florissant beds, biostratigraphy: Durden, Christopher J. 3083
Gulf Coastal Plain
Gastropoda, turritellas, classification: Allison, Richard C. 2959
Mississippi-Alabama, Ostracoda, Oligocene: Mumma, Martin Dale. 3294
Gulf of Mexico
Correlation, Oligocene-Miocene, Foraminifera, *Miogypsina*, indicator: Barker, R. Wright. 2936
Mammalia
Miacidae: MacIntyre, Giles Ternan. 3242
Montana
Deer Lodge area, Rodentia, Tavenner Ranch local fauna: Wood, Albert E. 2829
Nevada
Grant Range: Scott, Robert Blackburn, 3d. 3112
New Mexico
Walnut Wells quadrangle, stratigraphy: Zeller, Robert A., Jr. 3006
Nicaragua
Stratigraphy: Engels, Bruno. 3020
North America
Aves, Pliocene origin, discredited: Selander, Robert K. 3336
North Dakota
Cannonball Formation, biostratigraphy: Cvancara, Alan Milton. 3221
Oregon
Aldrich Mtn. quadrangle, stratigraphy and deformation: Thayer, T. P. 2967
Southwestern, stratigraphy and tectonics: Koch, John G. 2975
Texas
Gulf coast, Littig Conglomerate, Paleocene, Brachiopoda: Stenzel, H. B. 2874
Trinidad
Cruse and Forest Formations, Foraminifera, assemblages, ecology: Batjes, D. A. J. 3165
Guapo Bay, Morne l'Enfer Formation: Saunders, J. B. 3278
Washington
Gastropoda, Raging River Formation, turritellid: Allison, Richard C. 2959
Grays Harbor County, Montesano Formation, stratigraphy and Foraminifera: Fowler, Gerald Allan. 3225

Texas
Economic geology
Petroleum and natural gas, Big Hill field: Dollison, R. S. 2986
Petroleum, northern, Ellenburger pools: Cole, Frank W. 3032
Petroleum, southeastern, possibilities: Halbouty, Michel T. 2974
Hydrogeology
Camp, Franklin, Morris, Titus Counties, Cypress aquifer: Broom, M. E. 2992

Texas
Hydrogeology
Jackson County, Gulf Coast aquifer: Baker, E. T., Jr. 3030
Paleontology
Brachiopoda, Paleocene, Littig Conglomerate, Littig area: Stenzel, H. B. 2874
Petrology
Davis Mts., central, igneous rocks: Anderson, Jay Earl, Jr. 3218
Sedimentary petrology
Coastal Bend area, sedimentation, hurricane effects: Hayes, Miles Oren. 2973
Kimble County, caliche: Blank, Horace R. 3015
West Texas basin, Permian evaporites, cf. recent deposits off Mexico: Moore, George W. 3157
Stratigraphy
Cenozoic, Tertiary Pleistocene Gulf Coast aquifer, Jackson County: Baker, E. T., Jr. 3030
Cretaceous, Lower, southeastern: Halbouty, Michel T. 2974
Jurassic, Upper, southeastern: Halbouty, Michel T. 2974
Montague County to Carter County, Oklahoma, cross section: Ardmore Geological Society. 2916
Structural geology
Davis Mts., central: Anderson, Jay Earl, Jr. 3218
Weathering
Kimble County, caliche, formation in place: Blank, Horace R. 3015
Thermal springs
Waters
Metal content: White, D. E. 2928
Thermodynamic properties
Elastic properties
Rock around mine openings, sonic probe: Larocque, G. E. 3068
Viscosity of the Earth's mantle, relation to earthquake foci: Anderson, D. L. 2954
Weathering layer, experimental studies: Aldrich, Charles Allen. 3149
Free energy
Alumina–silica system, solid phases: Weill, D. F. 3047
Titanium
Geochemistry
Basalt, content: Chayes, Felix. 3287
Trace elements
Abundance
Deep-sea sediments: Bender, M. L. 2957
Trace-element analyses
Asbestos
Spectrochemical: Harington, J. S. 3275
Basalt
Palladium content, activation analysis: Crocket, James H. 3090
Limestone
Oolitic, strontium content: Kahle, Charles F. 3194
Trace-element analyses
Quartz diorite
Canada, Sudbury, activation analysis: Crocket, James H. 3090
Saint Marks enstatite chondrite
Uranium, distribution, fission method: Hamilton, E. I. 2950
Ultrabasic rocks
Palladium content, activation analysis: Crocket, James H. 3090
Trilobita
General
Photography of early growth stages: Whittington, H. B. 2812
Preparation techniques: Rasetti, Franco. 2826
Trinidad
Areal geology
Geologic evolution, compared with Venezuela: Salvador, A. 3170
Economic geology
Petroleum and natural gas, fields: Ablewhite, K. 3277
Petroleum, Forest Reserve field: Bower, T. H. 3166
Paleontology
Fauna, Jurassic–Cretaceous, Northern Range: Furrer, M. A. 3167
Foraminifera, Miocene, Cruse and Forest Formations, ecology: Batjes, D. A. J. 3165
Petrology
Rio Seco and Grande Reviere Formations, origin: Furrer, M. A. 3167
Sedimentary petrology
Cipero Formation, Herrera sands, turbidites: Poole, W. G. 3168
Guapo Bay, Morne l'Enfer Formation, upper: Saunders, J. B. 3278
Stratigraphy
Northern Range, Jurassic–Cretaceous: Potter, H. C. 3169
Tertiary, Morne l'Enfer Formation, Guapo Bay: Saunders, J. B. 3278
Structural geology
Northern Range, eastern: Potter, H. C. 3169
United States
Absolute age
Great Plains, northern, Quaternary, C-14: Lemke, R. W. 3244
Economic geology
Coal, Appalachian region, sulfur content: Deurbrouck, A. W. 3003
Geomorphology
Great Plains, northern, drainage changes, Pleistocene: Lemke, R. W. 3244
Great Plains, southern, terraces, Wisconsin substages: Frye, John C. 3299
Southwestern, arroyo cutting and capture: Wertz, Jacques B. 3188
Glacial geology
Great Plains, northern, general: Lemke, R. W. 3244
Quaternary, concepts, history of growth: Flint, Richard Foster. 3317
Quaternary, review volume: Wright, H. E., Jr. 3285

United States
Paleoclimatology
Quaternary, northeastern, palynology: Davis, Margaret B. 3332
Quaternary, southwestern, palynology: Martin, Paul S. 3333
Paleomagnetism
Quaternary, correlation: Cox, Allan. 3207
Paleontology
Insecta, Pleistocene, dispersals: Ross, Herbert H. 3306
Man, fossil, Quaternary, Great Plains, sites and artifacts: Stephenson, Robert L. 3314
Man, fossil, Quaternary, northeastern, artifacts: Ritchie, William A. 3212
Man, fossil, Quaternary, northeastern, fluted points evidence: Griffin, James B. 3318
Man, fossil, Quaternary, Pacific Coast: Meighan, Clement W. 3209
Man, fossil, Quaternary, southeastern, fluted points evidence: Williams, Stephen. 3286
Palynology, Quaternary, eastern, unglaciated, diagram: Whitehead, Donald R. 3310
Palynology, Quaternary, northeastern: Davis, Margaret B. 3332
Palynology, Quaternary, Pacific Northwest: Heusser, Calvin J. 3302
Palynology, Quaternary, southwestern: Martin, Paul S. 3333
Quaternary, review volume: Wright, H. E., Jr. 3285
Stratigraphy
Cretaceous, midcontinent, gravels: Owen, D. E. 3118
Quaternary, Basin and Range province, southern: Kottlowski, Frank E. 3312
Quaternary, concepts, history of growth: Flint, Richard Foster. 3317
Quaternary, continental shelf, changes of level: Curray, Joseph R. 3283
Quaternary, Great Basin: Morrison, Roger B. 3301
Quaternary, Great Plains, northern, Wisconsin stage: Lemke, R. W. 3244
Quaternary, Great Plains, southern: Frye, John C. 3299
Quaternary, paleomagnetic correlation: Cox, Allan. 3207
Quaternary, paleosols: Ruhe, Robert V. 3208
Quaternary, review volume: Wright, H. E., Jr. 3285
Quaternary, western, ash falls as markers: Wilcox, Ray E. 3206
Structural geology
Tectonic features and events, Quaternary: King, Philip B. 3284
Volcanology
Western, Quaternary ash falls: Wilcox, Ray E. 3206
Uranium
Abundance
Silicates and St. Marks chondrite,fission method:Hamilton,E. I. 2950
Uranium
New Mexico
Ambrosia Lake district, Section 22 mine, properties: Corbett, Robert Guy. 3220
McKinley County, Sec. 23 mine, occurrence: Young, W. E. 3058
Utah
Areal geology
Soldier Summit quadrangle: Moussa, Mounir Tawfik. 3134
Sedimentary petrology
Uinta Basin, Duchesne River Formation, cementation, significance: Warner, Mont M. 3192
Vermont
Sedimentary petrology
Burlington area, glacial sediments, late: Thomas, Hugo Frederick. 3162
Vertebrata
Evolution
Geographic elements: Simpson, George Gaylord. 3063
Microfossils
Collecting techniques, washing and screening: McKenna, Malcolm C. 2784
Quaternary
Kansas, McPherson Formation, *Equus* beds: Semken, Holmes Alford, Jr. 3235
Tetrapoda
Collecting techniques: Hotton, Nicholas, 3d. 2774
Virginia
Geomorphology
Southeastern, sea level cycles, post Miocene: Oaks, Robert Quincy, Jr. 3135
Petrology
Albemarle County, Old Dominion area, soapstone deposits: Greenberg, S. S. 3069
Stratigraphy
Cenozoic, southeastern, post Miocene: Oaks, Robert Quincy, Jr. 3135
Volcanism
Ash falls
Quaternary markers, western U.S.: Wilcox, Ray E. 3206
Volcanoes
Costa Rica
Cordillera Volcanica Central, Recent activity: Dondoli B., Cesar. 3024
Hawaii
Kilauea, infrared study of structure: Fischer, William A. 3276
Washington
Areal geology
Big Bend area: Grolier, Maurice Jean. 3130
Glacial geology
Columbia Plateau, general: Richmond, Gerald M. 3300
History, Pleistocene ice advances: Crandell, Dwight R. 3255
Mount Rainier, Nisqually Glacier, history: Meier, Mark F. 3315

Washington
Paleontology
Foraminifera, Miocene, Montesano Formation, Grays Harbor County: Fowler, Gerald Allan. 3225
Gastropoda, Eocene, Raging River Formation, turritellid: Allison, Richard C. 2959
Stratigraphy
Tertiary, Montesano Formation, Grays Harbor County: Fowler, Gerald Allan. 3225
Western, Paleozoic Cenozoic limestones, Cordilleran eugeosynclinal sequences: Danner, Wilbert R. 2933
Weathering
Caliche
Texas, Kimble County, in situ formation: Blank, Horace R. 3015
Copper deposits
Disseminated, ore guide: Durek, Joseph John. 3147
Granitic rocks
Geochemical and mineralogic studies: Harriss, Robert Curtis. 3101
Well logging
Electrical
Conversion for seismic time sections: Ivanhoe, L. F. 2844
Data, Louisiana, southwestern, water quality: Whitman, Harry M. 3029
Wells and drill holes
Alaska
Barrow area, Pleistocene cores, frozen ground: Sellman, Paul V. 2910
Illinois
Rock Island area, Precambrian basement: Buschbach, T. C. 2998
Mississippi
Clay, Lowndes, Monroe, Oktibbeha Counties, well records: Wasson, B. E. 2995
Texas
Jackson County, logs: Baker, E. T., Jr. 3030
West Indies
Stratigraphy
Cretaceous Tertiary paleogeography: Weyl, Richard. 2871
Structural geology
Orogenesis: Weyl, Richard. 2871
West Virginia
Economic geology
Petroleum and natural gas, resources: Haught, Oscar L. 3186
Wisconsin
Glacial geology
General: Frye, John C. 3245
Stratigraphy
Precambrian, Pine River and Keys Lake quartzites, Florence County: Nilsen, Tor H. 3290
Quaternary, general: Frye, John C. 3245
Worms
Tullimonstrum gregarium
Pennsylvanian, Illinois, Francis Creek shale: Richardson, E. S., Jr. 2955
Wyoming
Economic geology
Coal, Rock River quadrangle: Hyden, Harold J. 3022
Gravel, coal, petroleum, natural gas, Bosler quadrangle, possibilities: McAndrews, Harry. 2860
Mineral resources, Lake Ione quadrangle, possibilities: McAndrews, Harry. 2964
Petroleum, natural gas, coal, gravel, Pierce Reservoir quadrangle: Hyden, Harold J. 3004
Maps
Aeromagnetic, Seminoe Mts. area, Carbon County: Philbin, P. W. 2969
Geologic, Bosler quadrangle: McAndrews, Harry. 2860
Geologic, Clark quadrangle: Pierce, William G. 2854
Geologic, Deep Lake quadrangle: Pierce, William G. 2853
Geologic, Lake Ione quadrangle: McAndrews, Harry. 2964
Geologic, Miners Delight quadrangle: Bayley, Richard W. 2832
Geologic, Pierce Reservoir quadrangle: Hyden, Harold J. 3004
Geologic, Rock River quadrangle: Hyden, Harold J. 3022
Paleontology
Mammalia, Eocene, Lysite Member of Wind River Formation: Guthrie, Daniel Albert. 3293
Palynology, Cretaceous, Lower, northern: Davis, Phillip Nixon. 3127
Petrology
Yellowstone Park, potash rich basalts termed shoshonites: Joplin, Germaine A. 3325
Sedimentary petrology
Morrison Formation, calcite spherulites: Weiss, Malcolm P. 3178
Stratigraphy
Clark quadrangle, section: Pierce, William G. 2854
Cretaceous, Lower, northern: Davis, Phillip Nixon. 3127
Deep Lake quadrangle, sections: Pierce, William G. 2853
Lake Ione quadrangle, section: McAndrews, Harry. 2964
Miners Delight quadrangle, section: Bayley, Richard W. 2832
Pierce Reservoir quadrangle, section: Hyden, Harold J. 3004
Rock River quadrangle, section: Hyden, Harold J. 3022
X-ray diffraction analysis
Data
Weddellite and whewellite: Hutton, C. Osborne. 3324
Technique
Petrofabrics, fine-grained rocks: Chen, Ju-chin. 2988